4 Completing Followup of BURP Field Activities

After the main field activities are finished, there are a few things that must be done before leaving the site, while leaving the site, and after returning to the office. They are shown in the last box in Figure 36.

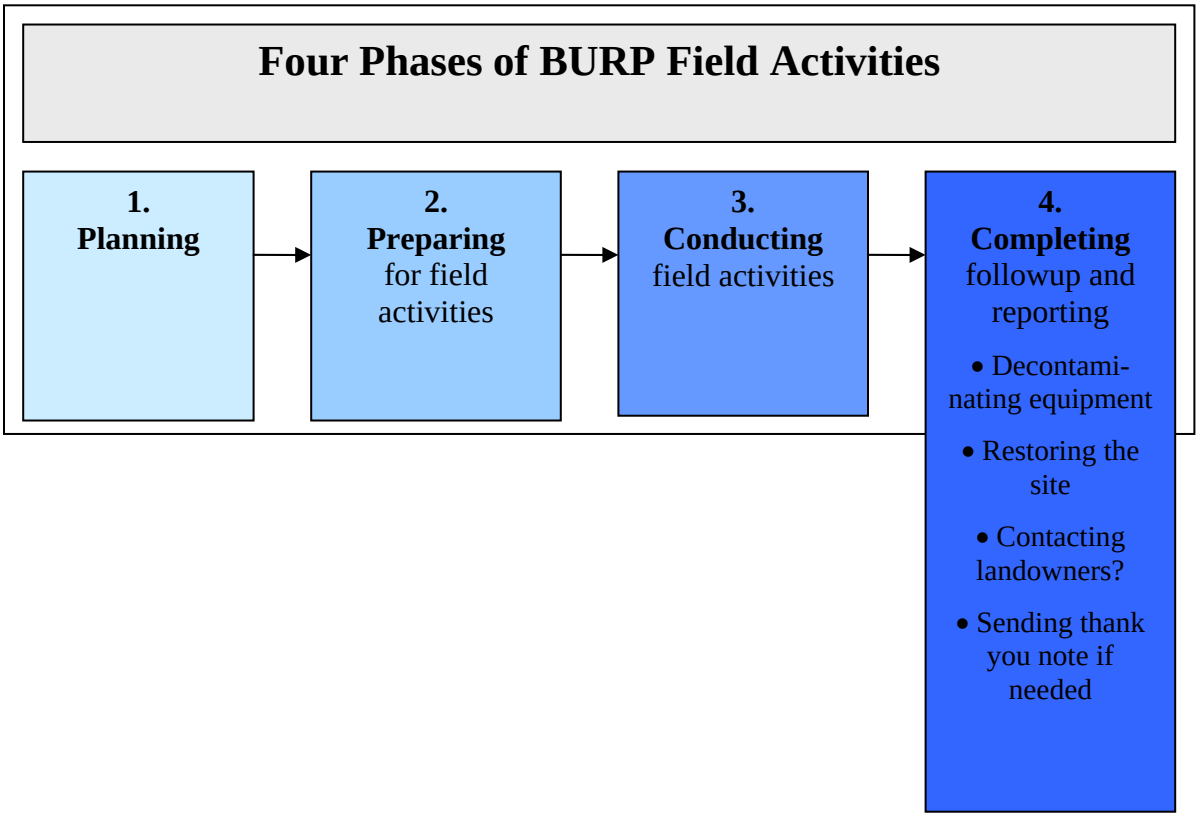

Figure 36. Steps in the Followup phase.

4.1 When Leaving a Site

4.1.1 Decontaminating Equipment

DEQ does not want its monitoring activities to cause the spread of noxious weeds, diseases of aquatic organisms, or exotic flora and fauna. Decontamination entails making BURP equipment and the area safe by eliminating harmful substances. Take special care to perform decontamination steps as described below before moving from one area to another.

The following procedures were adapted from the New Zealand Mud Snail Control and Management Plan for Colorado (D.O.W., 2005) and should be followed upon exiting all waters. Wading gear should be cleaned prior to leaving the site. If this is not possible then wading gear

should be completely sealed inside a large plastic bag and cleaned before it is used in any other waters.

Field Protocol for Removing New Zealand Mud Snails from Wading and Sampling Gear

Equipment needed:

- 5 gallon bucket with lid containing Sparquat 256 solution (4-6 oz of Sparquat per gallon of water)
- 5 gallon bucket with lid containing clean water
- Stiff bristled brush
- Latex gloves, eye protection

Cleaning Protocol:

1. Before exiting the stream use a stiff bristle brush to remove mud and debris from boots.
2. Remove wading gear immediately after exiting stream and make sure infested gear does not come in contact with other equipment. If you use separate wading boots, then remove the insoles from the boots.
3. It is recommended that you wear latex gloves and eye protection when using Sparquat 256. This product is an industrial cleaner and standard safety precautions should be followed.
4. Place waders, boots and insoles, and sampling equipment in the Sparquat 256 solution for a minimum of 10-15 minutes (solution may be reused several times).
5. Remove from solution and inspect gear to make sure all snails have been removed.
6. Rinse by immersing and agitating in the bucket of clean water. Do not use stream water to rinse gear or you may reintroduce snails.
7. Do not discard the Sparquat 256 solution or the rinse water in the field. Instead, cap the buckets, return to your office and dispose of the liquid down a drain that is routed to a waste water treatment plant.

* Use waders with boots attached (versus stocking foot waders with separate boots) because snails can easily get trapped in laces and inside of boots.
* Do not use waders with felt soles.
* Sparquat 256 will also kill whirling disease spores (*Myxobolus cerebralis*).

4.1.2 Restore the Site to the Way It Was Upon Arrival

Make every effort to restore the site to the condition it was in when the crew arrived. Be sure to remove all markers, stakes, and ribbons as well as all equipment and supplies. Leave all gates as they were; open if they were open and closed if they were closed. If at all possible, avoid driving over soft terrain which can leave damaging vehicle tracks.

4.1.3 Contact the Landowner

Many private landowners and public lands caretakers appreciate being contacted by the BURP crews as they leave a site. If it is feasible, try to contact the landowners or caretakers when leaving to express thanks and to notify them of your departure from the property. It is often helpful to convey any positive comments regarding their property or the stream. If they ask

about indications of impairment, be honest but do not theorize or place blame for any degraded conditions you observed.

4.2 Back in the Office

There are several things that must be done back in the office, some immediately and some within a few days:

- Submit samples to the lab.
- Handle data properly, filing notes and other information.
- Send thank you notes to landowners and caretakers that you didn't contact in person when leaving their sites.

5 Quality Assurance and Quality Control

The data collected in the field is of little use unless its quality is assured by QC practices. In order for DEQ to make maximum use of the BURP data, it is essential that the BURP protocols in this field manual and the QC practices in the QA/QC manual, *Beneficial Use Reconnaissance Program Quality Assurance Plan for Field Data Sheets and Data Handling on Wadeable (Small) Streams (Pappani et al., 2007, in progress)* are followed.

Collection of reliable and accurate monitoring and measurement data is the goal of the QA program. DEQ's QA program enhances data accuracy, reliability, and consistency, through 1) annual BURP Coordinator workshops, 2) extensive BURP field crew training, 3) consistent crew supervision, 4) comprehensive field audits, and 5) various QA/QC activities. Each of these is discussed below.

5.1 BURP Coordinator Workshops

Each year, BURP coordinators review protocols, to learn new methods, and exchange ideas on improving data collection efficiency and accuracy during several meetings and one workshop The workshop is conducted before each field season and provides training materials and instruction methods, training on new methods, and examples of properly recorded measurements. If any protocols are changed, the BURP Field Manual is updated accordingly.

5.2 Crew Management

Because of the many variables measured and samples taken, training the seasonal crews is essential for the success of the BURP program. DEQ strives for statewide consistency of the monitoring data and has chosen mandatory centralized training of the BURP field crews as the best way to accomplish this objective. All crew members receive comprehensive and consistent training about DEQ policies and BURP methods. This includes new crew members and "returnees," those who have worked on a BURP crew before. Crews are usually trained during the last two weeks in June, before the field season starts July 1. Currently, the training takes eight full days. It includes a small amount of lecture in the office, but is mainly done in the field. The crews learn all aspects of the methods presented in the BURP Field Manual. The majority of the training consists of hands-on demonstrations first by the DEQ instructors, then by the crew members, to demonstrate their ability to perform each method. Other training methods include viewing instructional materials and lecture and discussion sessions. The crews are introduced to as many different types of streams, land uses, and ecoregions as possible during the training.

BURP crew members receive extensive training before beginning field work. They learn the correct procedures for taking samples and measurements and how to properly fill out the BURP field forms, an important part of accurate data entry and overall quality assurance. In addition, they receive important information about personal safety, QC, vehicle and equipment maintenance, and proper etiquette.

5.3 Supervision of Crew Adherence to Standards

Each BURP crew is supervised throughout the monitoring season by a BURP Coordinator who accompanies crews periodically throughout the monitoring season to ensure their continuing adherence to the BURP Field Manual and DEQ policy.

5.4 Field Audits

A field audit team consists of one or more members of the DEQ state office staff, accompanied by a Coordinator from another DEQ region who was involved with the centralized crew training. The audit team observes crews performing measurements and collecting and preserving samples at a site. Each crew is audited within approximately two weeks of crew training. Each crew is audited at least once per season. The Coordinators use the audit findings to ensure the crew's performance is consistent and adheres to methods to meet QA requirements.

After the audit is completed, the audit team briefs the crew on-site. The audit team prepares a written report of audit results immediately following the audits and distributes it to DEQ regional managers, coordinators, and other staff.

5.5 Quality Assurance

5.5.1 Data Handling

Data handling by BURP crews and coordinators prior to submittal to the state office is considered part of the sampling process. The data handling process at the state office is guided by the most recent version of the QA/QC manual (currently, the *Beneficial Use Reconnaissance Program Quality Assurance Plan For Field Data Sheets and Data Handling on Wadeable (Small) Streams* (Pappani et al., 2007, in progress)). Briefly, the QA process requires review of data sheets by the DEQ state office QA crew and data entry by DEQ's data management staff in the state office Technical Services Division.

5.5.2 Sample Handling

BURP crews are trained to handle all samples as gently as possible and to take extra care with macroinvertebrate samples, as excessive shaking and jarring can destroy macroinvertebrate samples. Crews are also trained on how to label samples correctly and on the importance of correct labeling.

5.5.3 Sample Vouchering

Voucher specimens should be archived for future reanalysis, identification, and other research (Bailey et al., 2001; New, 1998). Voucher specimens should be stored in appropriate containers and preservatives. Voucher labels should include necessary information such as location, date, and collector's name, and be printed on archival paper. Presently, most BURP specimens are deposited in the Orma J. Smith Museum of Natural History, Albertson College of Idaho, Caldwell, ID. Amphibian specimens are also deposited at the Idaho Museum of Natural History, Idaho State University, Pocatello. Voucher specimens that are deposited at the museums are then available for any later verification that might be needed and for future research opportunities. DEQ will continue to support voucher specimens as resources allow.

5.5.4 Equipment Calibration

Calibrating the equipment means adjusting precisely for a particular function. In order to obtain the most accurate and precise information, the BURP Coordinators are responsible for calibrating or standardizing each piece of monitoring equipment that requires it before each field season. Calibrating a piece of equipment tells how accurate its measurements are. Equipment calibration also insures the integrity of the data.

Before the beginning of each monitoring year, the conductivity meter and flow meter are sent in for factory calibration and maintenance. The field crew inspects the lab-grade and field thermometers weekly and calibrates them monthly to confirm instrument integrity. The field crew also calibrates the conductivity meter monthly. The crew maintains a calibration log for each instrument.

5.6 Data Analysis and Interpretation

This field manual describes how to conduct a survey following the BURP process. This description includes BURP survey assumptions, methods, data handling, and required equipment. This document is not intended to describe the analysis and interpretation of the data collected. That information is found in the *Water Body Assessment Guidance* (Grafe, C. S. et al., 2002).

6 Safety

DEQ takes safety very seriously. Consequently, there are several policies to ensure safety when performing monitoring activities. These include mandatory training in cardiopulmonary resuscitation (CPR) and first aid, hazardous substances, and electrofishing safety. DEQ also provides comprehensive training regarding employment and safety policies during regional orientation and centralized training.

6.1 CPR and First Aid

All BURP crew members and DEQ staff who perform monitoring activities must be trained and certified in CPR and first aid to increase safety during all BURP field work, particularly during training and electrofishing.

6.2 Hazardous Situations and Substances

6.2.1 Hazardous Materials

No BURP crew member is authorized to endanger his life or the lives of others with exposure to hazardous materials, laboratory waste, or drug paraphernalia. DEQ provides training to help identify potentially hazardous substances and situations that may be found at monitoring sites or during travel. This training is intended to provide awareness and to help crew members recognize these materials if they are encountered. Crew members are not trained or authorized to deal with hazardous materials found in the field. BURP Coordinators in consultation with HazMat Coordinators are encouraged to develop their own additional training programs specific to their regional areas.

Crew members are not authorized to collect or transport hazardous materials found in the field. However, they are authorized to determine the GPS coordinates of a site if it can be done without undue exposure and to report the site to the BURP Coordinator, who will then report it to the regional office HazMat Coordinator. Safety comes first in any situation.

BURP crews use a reduced concentration of formalin to preserve some samples in the field (currently fish and periphyton). Appendix E provides information on how to handle formalin safely.

6.2.2 Abandoned Mining Sites

BURP training includes awareness of safety issues surrounding abandoned mining sites. Crew members are not authorized to visit or enter abandoned mine land sites (especially adits and tunnels) without notifying the BURP Coordinator and the Abandoned Mine Lands Coordinator. BURP crews are not authorized to take water samples from abandoned mine land sites where ground water is discharging into a surface stream.

6.2.3 Laboratory Waste and Drug Paraphernalia

BURP training includes discussions of safety and health issues surrounding laboratory waste and drug paraphernalia that sometimes appears on public lands. Crew members are not authorized to collect or transport laboratory waste or drug paraphernalia without written authorization from the Regional Manager for Water Quality Protection. If possible without exceeding the exposure level or otherwise risking the health and safety of crew members and others, crew members may take GPS readings of the site (or near the site) and to report them to the BURP Coordinator, who will then report them to the HazMat Coordinator immediately for follow up.

6.3 Electrofishing

DEQ has several policies to address electrofishing safety issues. Specifically, DEQ has an electrofishing safety plan (Appendix G) that addresses safety issues concerning training, equipment, and procedures. BURP Coordinators, crew members, and other DEQ staff performing electrofishing activities must carefully review these policies and sign a form acknowledging they have received electrofishing orientation. DEQ also uses an electrofishing checklist to ensure equipment needs are met and safety issues are addressed (Appendix I).

7 Literature Cited

Allan, J. 1995. Stream ecology. Chapman & Hall, New York, NY.

Armantrout, N. 1998. Glossary of aquatic habitat inventory terminology. American Fisheries Society, Bethesda, MD.

Bailey, R., R. Norris and T. Reynoldson. 2001. Taxonomic resolution of benthic macroinvertebrate communities in bioassessments. Journal of the North American Benthological Society **20**(2): 280-286.

Bain, M. and N. Stevenson. 1999. Cover and refuge. *In* Aquatic Habitat Assessment. N. J. S. M.B. Bain (ed.). American Fisheries Society. Bethesda, MD.

Barbour, M., J. Gerritsen, B. Snyder and J. Stribling. 1999. Rapid bioassessment protocols for use in wadeable streams and rivers: periphyton, benthic macroinvertebrates, and fish. *Report* EPA 841-B-99-002. U.S. Environmental Protection Agency, Office of Water. Washington, D.C.

Bauer, S. and T. Burton. 1993. Monitoring Protocols to Evaluate Water Quality Effects of Grazing Management on Western Rangeland Streams. *Report* 910/R-93-017. U.S. Environmental Protection Agency, Region 10. Seattle, WA.

Braudrick, C. and G. Grant. 2000. When do logs move in rivers? Water Resources Research **36**(2): 571-583.

Burton, T. and G. Harvey. 1990. Estimating intergravel Salmonid Living Space Using the Cobble Embeddedness Sampling Procedure. *Report* Water Quality Monitoring Protocols - Report No. 2. Idaho Dept. of Health and Welfare, Division of Environmental Quality. Boise, ID. 39 pp.

Chandler, G., T. Maret and D. Zaroban. 1993. Protocols for Assessment of Biotic Integrity (fish) in Idaho Streams. Idaho Dept. of Health & Welfare, Division of Environmental Quality, Boise, ID.

Chapman, D. 1966. Food and Space as Regulators of Salmonid Populations in Streams. The American Naturalist **100**(913): 345-357.

Clark, W., T. Maret and D. o. E. Quality. 1993. Protocols for Assessment of Biotic Integrity (macroinvertebrates) for Wadable Idaho Streams. Idaho Dept. of Health & Welfare, Division of Environmental Quality, Boise, ID.

Clesceri, L., A. Greenberg and A. Eaton. 1998. Standard Methods for the Examination of Water and Wastewater, 20th edition. American Public Health Association-American Water Works Association-Water Environment Federation, Washington, D.C.

Corn, P. 1994. What we know and don't know about amphibian declines in the west. *In* Sustainable ecological systems: implementing an ecological approach to land management. W. Covington and L. DeBano (ed.). U.S. Dept. of Agriculture, U.S. Forest Service, Rocky Mountain Forest and Range Experimental Station. Fort Collins, CO**.** 59–67.

Cowley, E. 1992. Protocols for Classifying, Monitoring, and Evaluating Stream/Riparian Vegetation on Idaho Rangeland Streams. *Report* Water Quality Monitoring Protocols - Report No. 8. Idaho Dept. of Health & Welfare, Division of Environmental Quality. Boise, ID. 88 pp.

Cowley, E., T. Burton and S. Smith. 2006. Monitoring Streambanks and Riparian Vegetation - Multiple Indicators. *Report* Technical Bulletin No. 2005-02. U.S. Department of the Interior Bureau of Land Management. Boise, ID. 134 pp.

D.O.W. 2005. New Zealand Mud Snail Management Plan. *Report* Colorado Division of Wildlife, Aquatic Section. Denver, CO. 21 pp.

Davis, J., G. Minshall, C. Robinson and P. Landres. 2001. Monitoring Wilderness Stream Ecosystems. *Report* General Technical Report, RMRS-GTR-70. U.S. Dept. of Agriculture, U.S. Forest Service, Rocky Mountain Research Station. Ogden, UT. 137 pp.

EPA, E. P. A. 2002. Consolidated Assessment and Listing Methodology. *Report* U.S. Environmental Protection Agency. Washington, DC.

Fore, L. and W. Bollman. 2000. Stream habitat index. *In* Idaho stream ecological assessment framework: an integrated approach. C. Grafe (ed.). Idaho Department of Environmental Quality. Boise, ID. **1.** 107.

Fraley, J., D. Read and P. Graham. 1981. Flathead River fisheries study. Montana Department of Fish, Wildlife and Parks. Kalispell, MT.

Gordon, N., T. McMahon and B. Finlayson. 1992. Stream hydrology: an introduction for ecologists. John Wiley and Sons, New York, NY.

Gorman, O. and J. Karr. 1978. Habitat Structure and Stream Fish Communities. Ecology **59**(3): 507-515.

Grafe, C. 2002. Water Body Size Criteria. *In* Idaho small stream ecological assessment framework: an integrated approach:. C. Grafe (ed.). Idaho Department of Environmental Quality. Boise, ID**.** 2-1 - 2-5.

Grafe, C. S. 2004a. Selection of Reference Condition for Small Streams in Idaho: a Systematic Approach. Idaho Department of Environmental Quality. Boise, ID. 54 pp.

Grafe, C. S. 2004b. Surface water ambient monitoring plan - first edition. Idaho Department of Environmental Quality. Boise, ID. 68 pp.

Grafe, C. S., M. McIntyre, C. Mebane and D. Mosier. 2002. Water Body Assessment Guidance (Second Edition). Idaho Department of Environmental Quality. Boise, ID. 114 pp.

Graham, P., D. Read, S. Leather, J. Miller and K. Pratt. 1980. Flathead River Basin fisheries study. Montana Department of Fish, Wildlife and Parks. Helena, MT. 88 pp.

Harrelson, C., C. Rawlins and J. Potyondy. 1994. Stream channel reference sites: an illustrated guide to field technique. *Report* RM-245. U.S. Dept. of Agriculture, U.S. Forest Service. Fort Collins, Colorado.

Hawkins, C., J. Kershner, P. Bisson, M. Bryant, L. Decker, S. Gregory, D. McCullough, C. Overton, G. Reeves and R. Steedman. 1993. A Hierarchical Approach to Classifying Stream Habitat Features. Fisheries **18**(6): 3-12.

Hayslip, G. 1993. EPA Region 10 In-stream Biological Monitoring Handbook (for wadeable streams in the Pacific Northwest). *Report* EPA-910/9-92-013. U.S. Environmental Protection Agency, Region 10, Environmental Services Division. Seattle, WA. 75 pp.

Hem, J. 1985. Study and interpretation of the chemical characteristics of natural water. *Report* Water-Supply paper 2254. U.S. Geological Survey. 155-156.

Heyer, W., M. Donnelly, R. McDiarmid, L. Hayek and M. Foster, Ed. (Eds). 1994. *In* Measuring and monitoring biological diversity: standard methods for amphibians. Smithsonian Institution Press, Washington, DC.

Hoelscher, B. and T. Bjornn. 1989. Habitat, density and potential production of trout and char in Pend Oreille Lake tributaries. *Report* Project F-71-R-10, Subproject III, Job 8, Job Completion Report. Idaho Department of Fish and Game. Boise, ID.

Horton, G. 2001. Dictionary of Water Words: A Compilation of Technical Water, Water Quality, Environmental, Natural Resource and Water-related Terms. Great Basin Research, Natural Resources Information Group, Reno, NV.

Hunt, R. 1968. Effects of Habitat Alteration on Production, Standing Crops and Yield of Brook Trout in Lawrence Creek, Wisconsin. Symposium on salmon and trout in streams, Conference, University of British Columbia, Location.

Irving, D. 1987. Cutthroat trout abundance, potential yield, and interaction with brook trout in Priest Lake tributaries. University of Idaho. Moscow, ID.

Johnson, R., T. Wiederholm and D. Rosenberg. 1993. Freshwater biomonitoring using individual organisms, populations, and species assemblages of benthic macroinvertebrates. *In*

Freshwater biomonitoring and benthic macroinvertebrates. V. H. R. D.M Rosenberg (ed.). Chapman and Hall. New York, NY. **4.** 40-158.

Kolz, A. 1993. In-water Electrical Measurements for Evaluating Electrofishing Systems. *Report* U.S. Fish and Wildlife Service. Washington, D.C. 24 pp.

Kunkle, S., W. Johnson, M. Flora and J. Wilson. 1987. Monitoring Stream Water for Land-use Impacts: A Training Manual for Natural Resources Management Specialists. National Park Service, Water Resources Division, Fort Collins, CO.

Leopold, L., W. Emmett, H. Silvey and D. Rosgen. 1995. A guide to field identification of bankfull stage in the western United States. U.S. Dept. of Agriculture, U.S. Forest Service. Fort Collins, CO.

Lundberg, J. and L. McDade. 1990. Systematics. *In* Methods for fish biology. C. B. Schreck and P. B. Moyle (ed.). American Fisheries Society. Bethesda, MD**.** 65–108.

Maret, T., T. Burton, G. Harvey and W. Clark. 1993. Field Testing of New Monitoring Protocols to Assess Brown Trout Spawning Habitat in an Idaho Stream. North American Journal of Fisheries Management **13**(3): 567-580.

Maret, T., C. Robinson and G. Minshall. 1997. Fish Assemblages and Environmental Correlates in Least-Disturbed Streams of the Upper Snake River Basin. Transactions of the American Fisheries Society **126**(2): 200-216.

McGrath, C., A. Woods, J. Omernik, S. Bryce, M. Edmondson, J. Nesser, J. Shelden, R. Crawford, J. Comstock and M. Plocher. 2001. Ecoregions of Idaho (color poster with map, descriptive text, summary tables, and photographs):. U.S. Geological Survey. Reston, VA.

McIntyre, M. 1993. Beneficial use reconnaissance project coordinated water quality monitoring plan. Idaho Dept. of Health & Welfare, Division of Environmental Quality. Boise, ID.

McIntyre, M. 1994. Idaho State Wide Work Plan for Completing Beneficial Use Attainability and Status Surveys. Idaho Dept. of Health & Welfare, Division of Environmental Quality, Boise, ID.

Meador, M. and G. Survey. 1993. Methods for Characterizing Stream Habitat as Part of the National Water-Quality Assessment Program. *Report* 93-408. U.S. Geological Survey, Earth Science Information Center. Raleigh, NC.

Meixler, M. 1999. Water body identification. *In* Aquatic Habitat Assessment. M. B. Bain and N. J. Stevenson (ed.). American Fisheries Society. Bethesda, MD**.** 33-45.

Moore, A. 1967. Correlation and analysis of water-temperature data for Oregon streams. *Report* Water-Supply Paper 1819-K. U.S. Geological Survey. Washington, D.C. 53 pp.

Nelson, R., W. Platts, D. Larsen and S. Jensen. 1992. Trout Distribution and Habitat in Relation to Geology and Geomorphology in the North Fork Humboldt River Drainage, Northeastern Nevada. Transactions of the American Fisheries Society **121**(4): 405-426.

New, T. 1998. Invertebrate Surveys for Conservation. Oxford University Press.

Oswood, M. and W. Barber. 1982. Assessment of fish habitat in streams: Goals, constraints, and a new technique. Fisheries **7**(4): 8-11.

Overton, C., J. McIntyre, R. Armstrong, S. Whitwell and K. Duncan. 1995. User's guide to fish habitat: descriptions that represent natural conditions in the Salmon River Basin, Idaho. *Report* General Technical Report INT-GTR-322. U.S. Dept. of Agriculture, U.S. Forest Service. Ogden, UT. 142 pp.

Overton, C., M. Radko and R. Nelson. 1993. Fish Habitat Conditions Using the Northern/Intermountain Regions' Inventory Procedures for Detecting Differences on Two Differently Managed Watersheds. *Report* General Technical Report INT-300. U.S. Dept. of Agriculture, U.S. Forest Service, Intermountain Research Station. Ogden, UT.

Pappani, J. and M. Nelson. 2007, in progress. Beneficial Use Reconnaissance Program Quality Assurance Plan for Field Data Sheets and Data Handling on Wadeable (Small) Streams. Idaho Department of Environmental Quality. Boise, ID.

Plafkin, J., M. Barbour, K. Porter, S. Gross and R. Hughes. 1989. Rapid bioassessment protocols for use in streams and rivers: benthic macroinvertebrates and fish. *Report* EPA/444/4-89-001. U.S. Environmental Protection Agency. Washington, DC. 174 pp.

Platts, W. 1990. Managing Fisheries and Wildlife on Rangelands Grazed by Livestock: A Guidance and Reference Document for Biologists. Nevada Dept. of Wildlife; Trout Unlimited Canada distributor, Reno, NV.

Platts, W., C. Armour, G. Booth, M. Bryant, J. Bufford, S. Jensen, G. Lienkaemper, G. Minshall, S. Monsen and R. Nelson. 1987. Methods for evaluating riparian habitats with applications to management. *Report* General Technical Report INT-221. U.S. Dept. of Agriculture, U.S. Forest Service. Ogden, UT.

Platts, W. and R. Nelson. 1989. Characteristics of Riparian Plant Communities and Streambanks with Respect to Grazing in Northeastern Utah. *In* Practical Approaches to Riparian Resource Management. R. E. Gresswell and e. al (ed.). American Fisheries Society. Bethesda, MD**.** 73-81.

Pratt, K. 1984. Habitat use and species interactions of juvenile cutthroat and bull trout in the Upper Flathead River Basin. University of Idaho. Moscow, ID.

Radkte, D., J. Davis and F. Wilde. 1998. Specific electrical conductance, Section 6.3. *In* U.S. Geological Survey Techniques of water-resources Investigations, Book 9, Handbooks for Water-Resources, Section A. National Field Manual for the Collection of Water-Quality Data. R. Wilde and D. Radtke (ed.). U.S. Geological Survey. Reston, VA**.** 22 pp.

Rankin, E. 1995. Habitat indices in water resource quality assessments. *In* Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making. W. S. Davis and T. P. Simon (ed.). CRC Press. Boca Raton, FL**.** 181-208.

Reaser, J. 2000. Amphibian Declines: An Issue Overview. Federal Taskforce on Amphibian Declines and Deformities, Washington, D.C.

Reynolds, J. 1983. Electrofishing. *In* Fisheries techniques, 1st edition. L. A. Nielsen, D. L. Johnson and S. S. Lampton (ed.). American Fisheries Society. Bethesda, MD**.** 221–253.

Rieman, B. and J. McIntyre. 1993. Demographic and Habitat Requirements for Conservation of Bull Trout. *Report* General Technical Report INT-302. U.S. Dept. of Agriculture, U.S. Forest Service. Ogden, UT.

Rosen, B. 1995. Use of Periphyton in the Development of Biocriteria. *In* Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making. W. S. Davis and T. P. Simon (ed.). CRC Press. Boca Raton, FL**.** 209-215.

Rosenberg, D. and V. Resh. 1993. Introduction to freshwater biomonitoring and benthic macroinvertebrates. *In* Freshwater Biomonitoring and Benthic Macroinvertebrates. D. M. Rosenberg and V. H. Resh (ed.). Chapman and Hall. New York, NY.

Rosgen, D. and H. Silvey. 1996. Applied river morphology. Wildland Hydrology, Pagosa Springs, CO.

Round, F. 1991. Diatoms in river water-monitoring studies. Journal of Applied Phycology **3**(2): 129-145.

Royer, T. and G. Minshall. 1996. Development of biomonitoring protocols for large rivers in Idaho. *Report* Stream Ecology Center, Department of Biological Sciences, Idaho State University. Pocatello, ID. 55 pp.

Scrivener, J. and M. Brownlee. 1989. Effects of forest harvesting on spawning gravel and incubation survival of chum (Oncorhynchus keta) and coho salmon (O. kisutch) in Carnation Creek, British Columbia. Canadian Journal of Fisheries and Aquatic Sciences **46**(4): 681-696.

Shepard, B. 1983. Evaluation of a Combined Methodology for Estimating Fish Abundance and Lotic Habitat in Mountain Streams of Idaho. University of Idaho. Moscow, ID.

Shepard, B., J. Fraley, T. Weaver and P. Graham. 1982. Flathead River fisheries study. *Report* Montana Department of Fish, Wildlife and Parks. Kalispell, MT.

Simon, T. and J. Lyons. 1995. Application of the index of biotic integrity to evaluate water resource integrity in freshwater ecosystems. *In* Biological assessment and criteria: tools for water resource planning and decision making. W. S. Davis and T. P. Simon (ed.). Lewis Publishers. Boca Raton, FL**.** 245–262.

Skille, J. 1991. In-stream Sediment and Fish Populations in the Little North Fork Clearwater River, Shoshone and Clearwater Counties, Idaho, 1988-1990. *Report* Water Quality Summary Report No. 27. Idaho Dept. of Health & Welfare, Division of Environmental Quality. Coeur d'Alene, ID.

Steed, R. and W. Clark. 1995. Idaho beneficial use reconnaissance project. 32nd Annual Meeting Idaho Chapter American Fisheries Society, Conference, American Fisheries Society, Location.

Stevens, H., J. Ficke and G. Smoot. 1975. Water temperature-influential factors, field measurement, and data presentation. U.S. Geological Survey, Arlington, VA.

Stevenson, N. and K. E. Mills. 1999. Streambank and shoreline condition. *In* Aquatic Habitat Assessment. M. B. Bain and N. J. Stevenson (ed.). American Fisheries Society. Bethesda, MD**.** 115-124.

U.S. Geological Survey. 2000. Geographic names information system (GNIS) Idaho. U.S. Geological Survey. Reston, VA. 479 pp.

Wolman, M. and A. Union. 1954. A Method of Sampling Coarse River-bed Material. Transaction of American Geophysical Union **35**: 951-956.

Young, M., W. Hubert and T. Wesche. 1991. Selection of Measures of Substrate Composition to Estimate Survival to Emergence of Salmonids and to Detect Changes in Stream Substrates. North American Journal of Fisheries Management **11**(3): 339-346.

Zaroban, D. 2000. Protocol for Placement and Retrieval of Temperature Data Loggers in Idaho Streams. Idaho Dept. of Health & Welfare, Division of Environmental Quality. Boise, ID. 34 pp.

8 Glossary

See the *Glossary of Aquatic Habitat Inventory Terminology* (Armantrout 1998) for a more complete glossary of aquatic habitat inventory terminology.

alluvial – related to material deposited by running water.

anode - the positive electrode.

anthropogenic-resulting from the influence of human beings on nature.

aquatic - pertaining to water; in this context, usually refers to plants or animal life living in, growing in, or adapted to water.

attainable use - a beneficial use that, with improvement, a waterbody could support in the future.

backwater pool – a pool caused by an eddy along the channel margin or by back-flooding upstream from an obstruction such as large woody debris, boulders or root wads.

bankfull depth – depth of water measured from the surface to the channel bottom when the water surface is even with the top of the streambank.

bankfull height – measure of bankfull stage from the water's surface to the bankfull stage

bank stability – the resistance of a bank to erosion.

beneficial use - any of the various uses that may be made of water, including, but not limited to, water supply (agricultural, domestic, or industrial), recreation in or on the water, aquatic biota, wildlife habitat, and aesthetics.

benthic zone – the bottom or bed of a water body.

canopy closure – the percentage of ground or water covered by shade from the outermost perimeter or natural spread of foliage from plants.

cascade – a highly turbulent series of short falls and small scour basins, with very rapid water movement as it passes over a steep channel bottom with gradients exceeding 8%.

cathode – the negative electrode.

chute – a narrow, confined channel through which water flows rapidly and smoothly; chutes are a class of runs.

conductivity – a measure of the ability of an aqueous solution to carry an electric current.

corner pool – see **meander pool.**

criteria - either a narrative or numerical statement of water quality on which to base judgement of suitability for beneficial use.

dammed pool – impoundment upstream of a complete or nearly complete channel blockage.

density – mass per unit volume.

designated use – a beneficial use listed for a waterbody or waterbodies in a state's water quality regulations.

discharge - commonly referred to as flow, expressed as volume of fluid per unit time (e.g. cubic feet per second) passing a particular point, in a river or channel or from a pipe.

eddy – a pool on the margin or off the main channel of a stream that is formed and maintained by strong eddy currents.

electrofishing – The use of electricity to provide a sufficient electrical stimulus in fish to permit easy capture by netting.

existing use - a beneficial use actually attained by a waterbody on or after November 28, 1975.

eutrophication - the process of nutrient enrichment in aquatic systems, such that the productivity of the system is no longer limited by the availability of nutrients. This is a natural process but may be accelerated by human activities.

Escherichia coli - This bacteria, often referred to simply as *E. coli*, is found in the normal intestinal flora of warm-blooded animals. It is pathogenic and its presence in water indicates that the water has been in contact with or contaminated by fecal material.

floodplain – land beyond a stream channel that forms the perimeter for the maximum probability flood.

fluvial – pertaining to or living in streams or rivers, or produced by the action of flowing water.

formalin – a 37 percent by weight aqueous solution of formaldehyde with some methanol.

glide – a portion of the stream with slow-moving, relatively shallow water. The water surface has little or no turbulence, and the stream bottom is flat or slightly convex in shape, lacking the scour associated with the pool.

grab sample – a single sample collected at a particular time and place.

habitat – the place where a population lives, and its living and non-living surroundings.

high gradient riffle – a collective term for rapids and cascades.

HUC – a watershed numbering system developed by the U.S. Geological Survey.

integrity – the extent to which all parts or elements of a system (e.g. aquatic ecosystem) are present and functioning.

interrupted flow – water flowing alternately on the channel surface in some stream reaches and disappearing underground in others.

laminar flow – uniform streamflow with no mixing or turbulence.

lateral scour pool – a pool that forms around local obstructions such as boulders or individual logs.

low gradient riffle – shallow reaches with swiftly flowing turbulent water with some partially exposed substrate, usually cobble or gravel.

macroinvertebrate – an invertebrate (without backbone) animal, large enough to be seen without magnification and retained by a 0.6mm screen.

meander pool – a pool resulting from a shift in the channel direction (meander) and found along the outer curves of the channel, where scouring occurs.

monitoring - to check or measure water quality (chemical, physical, or biological) for a specific purpose, such as attainment of beneficial uses.

nonpoint source - referring to pollution originating over a wide geographical area, not discharged from one specific location.

organic – materials resulting from vegetative growth, decay, and accumulation in closed basins or on gentle slopes where the rate of accumulation exceeds that of decay.

organism – any living thing composed of one or more cells.

periphyton - a term for benthic algae, which is commonly used to refer to all of the microflora on substrata.

plunge pool – a pool created by water passing over or through a complete or nearly complete channel obstruction, and dropping steeply into the streambed below scouring out a basin in the stream substrate where the flow radiates from the point of water entry.

point source – any discernable, confined, or discrete conveyance of pollutant, such as a pipe, ditch, or conduit.

pollution – any alteration in the character or quality of the environment due to human activity that makes it unfit or less suited for beneficial uses.

pool – an aquatic habitat in a stream with a gradient less than 1% that is normally deeper and wider than aquatic habitats immediately above and below it.

protocol – a collection of methods.

quality assurance – (QA) A program organized and designed to provide accurate and precise results. Examples include selection of proper technical methods, evaluation of data, quality control, and training of personnel. Its goal is to assure the data provided are of the quality needed and claimed.

quality control – (QC) Routine application of specific actions providing information for the quality assurance program. Examples include standardization, calibration and replication.

rapids – a moderately steep stream area with supercritical flow between 15 and 50%, rapid and turbulent water movement, surface with intermittent whitewater with breaking waves, coarse substrate, with exposed boulders at low flows, and a somewhat planar longitudinal profile.

reach – a relatively homogeneous stretch of a stream having a repetitious sequence of physical characteristics and habitat types; any specified length of a stream.

reconnaissance – an exploratory or preliminary survey of an area.

representativeness – the measure of the degree to which data accurately and precisely represent a characteristic of a population or environmental condition.

least impacted (reference) conditions – conditions which fully support applicable beneficial uses, with little impact from human activity and representing the highest level of support attainable.

riparian zone – natural home for plants and animals occurring in a thin strip of land bordering a stream or river; dominant vegetation often consists of phreatophytes.

riffle – a shallow reach with low subcritical flow in alluvial channels of finer particles that are unstable, characterized by small hydraulic jumps over rough bed material, causing small ripples, waves, and eddies, without breaking the surface tension.

riffle crest – the shallowest continuous line (usually not straight) across the channel close to where a water surface becomes continuously riffled.

river – the larger of BURP's two size designations for flowing water

run – a portion of the stream with swiftly flowing, relatively deep water, which approximates uniform flow. There are no major flow obstructions and little or no surface turbulence.

sample – a set of units or elements selected from a larger population, typically to be observed for making inferences regarding that population.

scour pool – a pool created by the scouring action of current flowing against an obstruction, causing an increase in lift and drag forces; a result of flow deflection, constriction, or increased local turbulence induced by a nonalluvial obstruction.

sediment – fine fragmented materials from weathered rocks and organic material that are suspended in, transported by, and eventually deposited by water or air.

sinuosity – the ratio of channel length between two points in a channel to the straight line distance between the same two points. Channels with sinuosities of 1.5 or more are called "meandering", while those close to 1.0 are called "straight".

stratification – the arrangement of water masses into distinct, horizontal layers that are separated by differences in density associated with water temperature and dissolved or suspended matter.

stream – a natural water course containing flowing water, at least part of the year, together with dissolved and suspended materials, that normally supports communities of plants and animals within the channel and the riparian vegetation zone.

stream order – hierarchical ordering of streams based upon the degree of branching. By the Strahler (1957) method, a first-order stream is an unforked or unbranching stream. Two first-order streams flow together to form a second-order stream, two second-order streams combine to make a third-order stream etc.

streambank – ground bordering a channel above the streambed and below the level of rooted vegetation that often has a gradient steeper than 45^{o} and exhibits a distinct break in slope from the stream bottom.

streambed - substrate plane, bounded by banks, of a stream bottom.

stream channel – a long, narrow depression shaped by the concentrated flow of a stream and covered continuously or periodically by water. Also, bed and banks formed by fluvial processes where a natural stream of water runs continually or intermittently.

stream classification – systems used to group or identify streams possessing similar features using geomorphic structure, water source, associated biota, or other characteristics.

streamflow – flow of water, generally with its suspended load, in a well-defined channel or water course.

substrate – mineral and organic material forming the bottom of a waterway or water body.

surface water – the collection of all natural bodies of water, including but not limited to streams, lakes, and wetlands, evident on the surface of the land.

targeted survey – the use of best professional judgment to choose sampling locations.

thalweg – a line joining the deepest points along successive cross-sections of a river channel.

trench pool – a pool that forms in a slot-like depression, usually found in bedrock channels; trench pools typically have long linear shapes.

turbidity – the reduction of transparency in water due to the presence of suspended particles.

turbulence – streamflows in which the velocity at a given point varies erratically in magnitude and direction and disrupts reaches with laminar flow.

waterbody – a specific body of water or geographically delimited portion thereof.

water quality – a term for the combined chemical, physical, and biological characteristics of water which affect its suitability for beneficial use.

wastewater - treated or untreated sewage, industrial waste, or agricultural waste and associated solids.

watershed – region or area drained by surface and groundwater flow in rivers, streams, or other surface channels. Also, the divide between two catchment (drainage) areas.

wetted width – the width of a water surface measured perpendicular to the direction of flow at a specific discharge.

width:depth ratio (W/D) – an index of the cross section shape of a stream channel, at bank-full level.

9 Index of Monitoring Variables

T

U

W

Z

Acknowledgements

The Beneficial Use Reconnaissance Program Field Manual has evolved since 1993 into its present form. Many people have contributed to the effort in the past.

This field manual was assembled with the assistance of the Beneficial Use Reconnaissance Program Technical Advisory Committee (Sean Woodhead, Jason Pappani, Christine Waite, Glen Pettit, Hawk Stone, Steve Robinson, Daniel Stewart and Mary Anne Nelson). Valuable review and comments were received from Barry Burnell, Michael McIntyre, Cynthia Barrett, Dr. Sonny Buhidar and Don Zaroban. Technical peer review was provided by Robert Steed and technical editing by Lisa Hansen.

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Appendix A

Sample Letter of Invitation to an Aquatic Monitoring Coordination Meeting

To Whom It May Concern:

The Idaho Department of Environmental Quality invites you to attend the 2002 Interagency Monitoring Coordination workshop. This once-a-year opportunity will allow you to network, exchange ideas, coordinate monitoring and become aware of the aquatic activities and/or monitoring proposed for this year in your areas of interest. Topics will revolve primarily around aquatic monitoring and restoration activities. Meeting attendees include representatives from private, local, state, and federal agencies.

If you plan to attend, please be prepared to give a brief overview of your aquatic monitoring/restoration activities this year and information detailing specific monitoring activities and locations. If you do not plan to attend, please send information indicating the type of monitoring you will be doing this year, location of this monitoring, and a contact name. In addition, please review the attached mailing list and provide me with any other pertinent contact names. We wish to insure this group is aware of all monitoring occurring within the basin.

Also, if you have any summaries from last year's efforts, please bring them as well. Attached is a proposed agenda for the meeting and mailing list. It is flexible so we can add more presenters if necessary.

This year's meeting will be held on (insert your date) at the DEQ Office, (insert your location). We will begin promptly at (insert the starting and ending times of the meeting). If you have any questions or suggestions, please contact me.

Sincerely,

(Name)

BURP Coordinator

DEQ (Address)

Phone: (208) (Phone Number)

email: (email address)

Appendix B

Informative Flyer About BURP Monitoring Activities

Idaho is well-recognized for its scenic streams, rivers, and lakes and abundant water recreation opportunities that attract visitors from around the globe.

To assure that Idaho's water bodies remain clean and available for drinking and recreation, continuous monitoring and evaluation are needed. The Idaho Department of Environmental Quality (DEQ) is charged with providing consistent water body monitoring and assessment. In 1993, DEQ initiated the Beneficial Use Reconnaissance Program, or BURP, to gather reliable data on the biology, chemistry, and habitat conditions of Idaho's water bodies.

Read this brochure to learn how BURP helps maintain the quality of Idaho's streams, rivers, and lakes.

For More Information

Visit DEQ's Web site for more information on BURP and water quality in Idaho:

Monitoring and Assessment
www.deq.idaho.gov/water/data_reports/surface_water/monitoring/overview.cfm

Water Quality Standards
www.deq.idaho.gov/water/data_reports/surface_water/monitoring/standards.cfm

DEQ's Surface Water Program Overview
www.deq.idaho.gov/water/prog_issues/surface_water/overview.cfm

Contact the DEQ Regional Office nearest you for information on how DEQ is working to maintain water quality in your area:

DEQ Regional Offices

Boise	373-0550
Coeur d'Alene	769-1422
Idaho Falls	528-2650
Lewiston	799-4370
Pocatello	236-6160
Twin Falls	736-2190

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Water in Idaho

Idaho's Beneficial Use Reconnaissance Program

Working to maintain the quality of our streams, rivers, and lakes

Idaho Department of Environmental Quality
www.deq.idaho.gov

What is BURP?

The Beneficial Use Reconnaissance Program, known as BURP, is a cost-effective, efficient monitoring survey of Idaho's streams. The purpose of BURP is to collect and measure key water quality parameters to aid DEQ in determining whether a water body is supporting its beneficial uses.

> *A beneficial use is any of the various uses of water, including, but not limited to, aquatic biota, recreation, water supply, wildlife habitat, and aesthetics.*

The federal Clean Water Act provides guidance for states to develop standards to protect water bodies based on their beneficial uses. For example, if a river is designated to support salmonid spawning, then standards are applied to ensure that the water quality is suitable for salmonid reproduction. In Idaho, beneficial use designations are required for aquatic life and recreation.

How BURP Data Are Collected

Each summer, DEQ technicians follow standardized procedures to:

- collect aquatic *insects and periphyton*
- conduct *fish* surveys and
- document *habitat* conditions from streams, rivers, and lakes.

BURP surveys are performed during the same low-flow time period each year—July 1 to September 15—so the information is comparable from one year to the next.

Why monitor bugs?

The BURP procedure calls for the collection and analysis of aquatic insects and fish as "biological indicators." Biological indicators are used because they are very sensitive to changes in water quality, so their presence, abundance, and health serve as indicators of the overall quality of a water body. Generally, unpolluted waters support a greater variety of aquatic insects and fish than polluted waters.

Where BURP Surveys Are Conducted

To ensure assessments can be applied to longer stream reaches or entire streams, BURP monitoring sites must be representative. DEQ uses standard selection steps to identify potential sites.

BURP surveys are conducted on both public and private lands. DEQ's ability to enter private property is at the discretion of the property owner. If a private property is identified as a desirable monitoring location, DEQ always requests permission from the property owner before conducting any sampling. In addition, DEQ assures the landowner that BURP methods will not damage the property or resources.

How DEQ Ensures Quality

Data gathered from BURP monitoring are the basis for many surface water quality decisions made by DEQ. The quality of BURP data is ensured by providing centralized training for BURP crews, using a standardized manual, following annual work plans, conducting annual field reviews, and following a quality assurance plan.

How BURP Data Are Used

The BURP data are evaluated to determine if the water body is supporting beneficial uses.

If a water body is found to be not supporting beneficial ues, a water quality improvement plan, or total maximum daily load (TMDL), is developed. If a water body is found to be supporting beneficial uses, it will be monitored again in the future to ensure it continues to do so.

Appendix C

Field Equipment Checklist

Field Equipment Checklist

MACROINVERTEBRATE SAMPLE EQUIPMENT	Yes	No
Hess and Surber Samplers (500 μm mesh w/300 ml bucket)		
White pans		
Macro sample containers		
Preservative (95% ethanol)		
Spare nets for Samplers		
Rebar stake		
Scrub brush		
(wash) bottles for rinsing (water and alcohol)		
Field labels		
Field Data Forms		
Rubber gloves		
Flexible forceps (larval)		
Pencils/Indelible alcohol proof markers		

PERIPHYTON SAMPLING EQUIPMENT	Yes	No
Periphyton sampler		
Periphyton brush		
Pipette/eye dropper		
10% formalin solution & dropper		
Labels		

WOLMAN PEBBLE COUNT EQUIPMENT	Yes	No
Metric ruler (clear plastic) or angled measuring device		
Shoulder-length gloves		
Pencils/pens		
Field data sheets		
ELECTROFISHING EQUIPMENT	Yes	No
Collecting Permits or IDFG personnel		
Electrofisher		
Anode and Cathode		
Dip nets		
Waders (non breathable, non conductive material)		
Rubber gloves		
Specific Conductivity Meter		
Preservative: 10% buffered formalin solution		
Thermometer		
Small aquarium nets		
Anesthetic		
Buckets		
Gas/oil and spare spark plugs (if using gas-powered electrofisher)		
Generator (if using a battery-powered electrofisher) and spare parts		
Spare fuses		
Specimen vouchering containers		

Fish measuring board		
Fish identification keys		
Clipboard/notebook/fish labels		
Field data sheets		
First Aid Kit		
Polarized sunglasses		
Fire extinguisher		

FLOW MEASUREMENT EQUIPMENT	Yes	No
Current velocity meter		
Top-setting-wading rod		
Measuring tape graduated in 0.1 ft units		
Rebar stakes		
Flow sheets		
Pencils/clipboard		
Waders		
Extra batteries for current meter		

BACTERIA SAMPLING EQUIPMENT	Yes	No
Bacteria check sheet		
Sterilized bacteria sample bottles		
Indelible marker		
Cooler with ice		

MISCELLANEOUS EQUIPMENT	Yes	No
First Aid Kit		
Sunscreen		
Emergency equipment for vehicle		
GPS receiver		
Tool Kit		
Clinometer		
Densiometer		

2 meter rod		
Tape measures		
Random number table		
Field notebook/clipboards/tatum		
Maps		
"All" forms and labels		
Camera & film or memory card		
Extra batteries		
Current BURP Field Manual and Workplan		
Pens/pencils		
duct tape		
Bug spray		
Flagging/ribbon		

Appendix D

Material Safety Data Sheets (MSDS)

001 03/30/99 ETHANOL RED BAND III 190 PROOF

Section 1. Chemical Product

Product Name:	Ethanol Red Band III 190 proof
MSDS #:	CM0287
Date Issued:	3/29/99
Supersedes:	New
Issued By:	000099
Synonym:	Not available.
Trade Names:	Not available.
Material Uses:	Not available.

Section 2. Composition and Information in Ingredients

NAME	CAS #	% BY Weight	EXPOSURE LIMITS
Ethanol	64-17-5	90-95	TWA: 1880 (mg/m3) from ACGIH (TLV) TWA: 1000 (ppm) from ACGIH (TLV) TWA: 1900 (mg/m3) from OSHA TWA: 1000 (ppm) from OSHA
Water	7732-18-5	5	Not available.
Methyl alcohol	67-56-1	3-4	TWA: 262 STEL: 328 (mg/m3) from ACGIH (TLV) TWA: 200 STEL: 250 (ppm) from ACGIH (TLV) SKIN TWA: 260 STEL: 328 (mg/m3) from OSHA TWA: 200 STEL: 328 (ppm) from OSHA
Ethyl acetate	141-78-6	0-2	TWA: 1440 (mg/m3) from ACGIH (TLV) TWA: 400 (ppm) from ACGIH (TLV) TWA: 1400 (mg/m3) from OSHA TWA: 400 (ppm) from OSHA
Methyl isobutyl ketone	108-10-1	0-2	TWA: 205 STEL: 307 (mg/m3) from ACGIH (TLV) TWA: 50 STEL: 75 CEIL: 125 (ppm) from ACGIH (TLV) TWA: 410 STEL: 307 CEIL: 510 (mg/m3) from OSHA TWA: 100 STEL: 75 (ppm) from OSHA

Light aliphatic solvent naphtha (petroleum)	64742-89-8	0-2	Not available.

Ingredients not precisely identified are proprietary or nonhazardous under Federal Hazard Communication Standards (29 CFR 1910.1200).

Section 3. Hazards Identification

Physical State and Appearance - Liquid.

Emergency Overview
WARNING!
Keep away from heat, sparks and flame. Avoid contact with eyes. Avoid breathing vapors or spray mists.
Avoid contact with skin and clothing. Keep container closed. Use only with adequate ventilation. Wash
thoroughly after handling.

Routes of Entry
Dermal contact. Eye contact. Inhalation. Ingestion.
Potential Acute Health Effects
Eyes
Hazardous in case of eye contact (irritant).
Skin
Sensitization of the product: Not available.
Very hazardous in case of skin contact (irritant).
Slightly hazardous in case of skin contact
(permeator). Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.
Inhalation
Slightly hazardous in case of inhalation.
Ingestion
Slightly hazardous in case of ingestion.
Potential Chronic Health Effects
CARCINOGENIC EFFECTS: Classified A4 (Not classifiable for human or animal.) by ACGIH (Ethanol). Classified A4 (Not classifiable for human or animal.) by ACGIH (Ethyl acetate).
MUTAGENIC EFFECTS: Not available.
TERATEGENIC EFFECTS: Not available.
Medical Conditions Aggravated by Overexposure:
Repeated or prolonged exposure is not known to aggravate medical condition.
Overexposure/Signs/Symptoms - Not available.
See Toxicological Information (Section 11)

Section 4. First Aid Measures

Eye Contact

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact

After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cold water may be used. Cover the irritated skin with an emollient. If irritation
persists, seek medical attention. Wash contaminated clothing before reusing.

Hazardous Skin Contact

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation

Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Hazardous Inhalation

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.

Ingestion

Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Hazardous Ingestion - Not Available.

Notes to Physician - Not available.

Section 5. Fire Fighting Measures

Flammability of the Product
Flammable.
Auto-ignition Temperature
The lowest known value is 363 deg C (685.4 deg F) (Ethanol).
Flash Points
The lowest known value is CLOSED CUP: -4.4 deg C (24.1 deg F).
OPEN CUP: -4 deg C (24.8 deg F). (Cleveland). (Ethyl acetate)
Flammable Limits
The greatest known range is LOWER: 6% UPPER: 36.5%
(Methyl alcohol)
Products of Combustion
These products are carbon oxides (CO, CO2).
Fire Hazards in Presence of Various Substances
Flammable in presence of open flames and sparks, of heat, of combustible materials.
Slightly flammable to flammable in presence of oxidizing materials.
Explosion Hazards in Presence of Various substances
Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.
Fire Fighting Media and Instructions
Flammable liquid, soluble or dispersed in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use alcohol foam, water spray or fog.
Protective Clothing (Fire)
Be sure to use an approved/certified respirator or equivalent.
Special Remarks on Fire Hazards
Containers should be grounded. (Ethanol)
Special Remarks on Explosion Hazards - Not available.

Section 6. Accidental Release Measures
Small Spill
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.
Large Spill
Flammable liquid.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed.
Eliminate all ignition sources. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7. Handling and Storage
Handling
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/vapor/spray. Wear suitable protective clothing. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents.
Storage
No specific storage is required. Use shelves or cabinets sturdy enough to bear the weight of the chemicals. Be sure that it is not necessary to strain to reach materials, and that shelves are not overloaded.

Section 8. Exposure Controls/Personal Protection
Engineering Controls
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.
Personal Protection
Eyes - Splash goggles.
Body - Lab coat.
Respiratory - Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Hands - Gloves.
Feet -Not applicable.
Personal Protection in Case of a Large Spill
Splash goggles. Full suit. Vapor respirator. Boots.

Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Chemical Name or Product Name	Exposure Limits
Ethanol	**TWA: 1880 (mg/m3) from ACGIH (TLV)** TWA: 1000 (ppm) from ACGIH (TLV) TWA: 1900 (mg/m3) from OSHA TWA: 1000 (ppm) from OSHA
Methanol	TWA: 262 STEL: 328 (mg/m3) from ACGIH (TLV) TWA: 200 STEL: 250 (ppm) from ACGIH (TLV) SKIN TWA: 260 STEL: 328 (mg/m3) from OSHA TWA: 200 STEL: 328 (ppm) from OSHA
Ethyl acetate	TWA: 1440 (mg/m3) from ACGIH (TLV) TWA: 400 (ppm) from ACGIH (TLV) TWA: 1400 (mg/m3) from OSHA TWA: 400 (ppm) from OSHA
Methyl isobutyl ketone	TWA: 205 STEL: 307 (mg/m3) from ACGIH (TLV) TWA: 50 STEL: 75 CEIL: 125 (ppm) from ACGIH (TLV) TWA: 410 STEL: 307 CEIL: 510 (mg/m3) from OSHA TWA: 100 STEL: 75 (ppm) from OSHA
Light aliphatic solvent naphtha (petroleum)	Not available.

Consult local authorities for acceptable exposure limits.

Section 9. Physical and Chemical Properties

Physical State and Appearance

Liquid - Boiling/Condensation Point

The lowest known value is 64.7 deg C (148.5 deg F) (Methyl alcohol). Weighted average: 79.34 deg C (174.8 deg F)

Melting/Freezing Point

May start to solidify at 0 deg C (32 deg F) based on data for:

Water. Weighted average: -107.43 deg C (-161.4 deg F)

Color - Not available.

Specific Gravity - Weighted average: 0/8 (Water = 1)

Vapor Pressure - The highest known value is 97.68 mm of Hg (at 20 deg C) (Methyl alcohol). Weighted average: 42.15 mm of Hg (at 20 deg C)

Vapor Density

The highest known value is 3.45 (Air = 1) (Methyl isobutyl ketone). Weighted average: 1.62 (Air = 1)

Volatility

Odor Threshold

The highest known value is 180 ppm (Ethanol) Weighted average: 175.8 ppm

Evaporation Rate

The highest known value is 3.3 (Ethanol) Weighted average: 3.28 compared to Butyl acetate.

VOC

Viscosity -Not available
Solubility
Easily soluble in cold water, hot water, methanol, diethyl ether.
pH (1% Soln/Water)
Neutral.
Odor -Not available.
Taste -Not available.
Physical Chemical Comments -Not available.

Section 10. Stability and Reactivity
Stability and Reactivity
The product is stable.
Conditions of Instability - Not available.
Incompatibility with Various Substances
Reactive with oxidizing agents.
Non-reactive with acids, alkalis.
Hazardous Decomposition Products - Not available.
Hazardous Polymerization - Not available.

Section 11. Toxicological Information
Toxicity to Animals
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 2080 mg/kg (Rat).
(Methyl isobutyl ketone).
Acute dermal toxicity (LD50): 15800 mg/kg (Rabbit.).
(Methyl alcohol).Acute toxicity of the vapor (LC50): 8000 ppm 4 hour(s) (Rat.). (Ethanol).
Chronic Effects on Humans
CARCINOGENIC EFFECTS: Classified A4 (Not classifiable for human or animal.) by ACGIH (Ethanol). Classified A4 (Not classifiable for human or animal.) by ACGIH (Ethyl acetate).
DEVELOPMENTAL TOXICITY: PROVEN (Ethanol)
The substance is toxic to blood, the nervous system, the reproductive system, liver, upper respiratory tract, skin, eyes, respiratory tract, gastrointestinal tract, kidneys.
Other Toxic Effects on Humans
Very hazardous in case of skin contact (irritant). Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.
Special Remarks on Toxicity to Animals - Not available.
Special Remarks on Chronic Effects on Humans
0040 Passes through the placental barrier.
May be fatal or cause blindness if swallowed. (Methyl alcohol)
Special Remarks on Other Toxic Effects on Humans
Moderately toxic and narcotic in high concentrations.
Experimentally tumorigen. (Ethanol)

Section 12. Ecological Information
Ecotoxicity - Not available.
BOD5 and COD - Not available.
Biodegradable/OECD - Not available

Mobility - Not available.
Toxicity of the Products of Biodegradation
Possibly hazardous short term degradation products are not likely.
However, long term degradation products may arise.
The products of degradation are less toxic than the product itself.
Special Remarks on the Products of Biodegradation - Not available.

Section 13. Disposal Considerations
Waste Information - Not available.
Waste Stream - Not available.
Consult an expert on disposal of waste and material used in spill cleanup and ensure conformity to all federal, state and local disposal regulations. Regulatory requirements are subject to change and may differ from one location to another; the generator of the waste is responsible for proper waste disposal.

Section 14. Transport Information
DOT Classification
Class 3: Flammable liquid.
Ethanol, Solution UN1170 II

Marine Pollutant - Not available.
Hazardous Substances Reportable Quantity (Kg) - Not available.

Special Provisions for Transport - Not available.

Section 15. Regulatory Information
U.S. Federal Regulations
SARA 302/304 Emergency planning and notification:
No products were found.

CERCLA: Hazardous substances: Methyl alcohol: 5000 lbs. (2268 kg); Ethyl acetate: 5000 lbs. (2268 kg); Methyl isobutyl ketone: 5000 lbs. (2268 kg);

SARA 313 toxic chemical notification and release reporting: Methyl alcohol: 1%; Methyl isobutyl ketone: 1%.

TSCA 5 (e) substance consent order: Ethyl acetate; Methyl isobutyl ketone
TSCA 8 (a) PAIR: Methyl isobutyl ketone
TSCA 8 (a) IUR: Ethyl acetate; Methyl isobutyl ketone
TSCA 8 (b) inventory: Ethanol; Water; Mthyl alcohol; Ethyl acetate; Methyl isobutyl ketone; Light aliphatic solvent naphtha (petroleum)
TSCA 12 (b) one time export: Ethyl acetate; Methyl isobutyl ketone

SARA 311/312 MSDS distribution – chemical inventory – hazard identification: Ethanol: fire, immediate health hazard, delayed health hazard; Methyl alcohol: fire, immediate health hazard, delayed health hazard; Ethyl acetate: fire, immediate health hazard; Methyl

isobutyl ketone: fire, reactive, immediate health hazard; Light aliphatic solvent naphtha (petroleum): fire, immediate health hazard

State Regulations
Rhode Island RTK hazardous substances: Ethanol; Methyl alcohol; Ethyl acetate; Methyl isobutyl ketone
Pennsylvania RTK: Ethanol, Methyl alcohol: (environmental hazards); Ethyl acetate: (environmental hazard); Mthyl isobutyl ketone: (environmental hazard)
Florida: Ethanol; Methyl alcohol; Ethyl acetate; Methyl isobutyl ketone
Minnesota: Ethanol; Methyl alcohol; Ethyl acetate; Methyl isobutyl ketone
Massachusetts RTK: Ethanol; Methyl alcohol; Ethyl acetate; Methyl isobutyl ketone
New Jersey: Ethanol; Methyl alcohol; Ethyl acetate; Methyl isobutyl ketone
New Jersey spill list: Ethanol; Methyl alcohol; Ethyl acetate; Methyl isobutyl ketone

California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Ethanol

Section 16. Other Information

National Fire Protection Association (U.S.A.)

Health 1

Flammability 3

Reactivity 0

Specific

Hazard

Other Special Considerations - Not available.

This mixture has not been tested as a whole, the data presented is based on the properties of the individual components.

----------NOTICE----------

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IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE,

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WITH RESPECT TO THE PRODUCT OR INFORMATION PROVIDED HEREIN, AND SHALL UNDER

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* * * E N D OF M S D S * * *

MSDS

24 Hour Emergency Telephone: 908-859-2151

CHEMTREC: 1-800-424-9300
National Response in Canada
CANUTEC: 613-996-6666
From: Mallinckrodt Baker, Inc.
222 Red School Lane Outside U.S. and Canada
Phillipsburg, NJ 08865 Chemtrec: 202-483-7616

MALLINCKRODT

NOTE CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

FORMALDEHYDE SOLUTION, BUFFERED 10%

1. Product Identification

Synonyms: Formaldehyde solution, buffered, 10% (v/v) in aqueous phosphate buffer

CAS No: Not applicable to mixtures.
Molecular Weight: Not applicable to mixtures.
Chemical Formula: HCHO and CH_3OH in water.
Product Codes: H121

2. Composition/Information on Ingredients

Ingredient	CAS No.	Percent	Hazardous
Methyl Alcohol	67-56-1	1 – 1.5%	Yes
Formaldehyde	50-00-0	4%	Yes
Water	7732-18-5	-95%	No

DANGER! MAY BE FATAL IF SWALLOWED, HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT STRONG SENSITIZER MAY CAUSE BLINDNESS, COMBUSTIBLE LIQUID AND VAPOR. SUSPECT CANCER HAZARD CONTAINS FORMALDEHYDE WHICH MAY CAUSE CANCER. Risk of cancer depends upon duration and level of exposure.

3. Hazards Identification
Emergency Overview

Potential Health Effects

The perception of formaldehyde by odor and eye irritation becomes less sensitive with time as one adapts to formaldehyde. This can lead to overexposure if a worker is relying on formaldehyde's warning properties to alert him or her to the potential for exposure.

Inhalation:

May cause sore throat, coughing, and shortness of breath. Causes irritation and sensitization of the respiratory tract. Concentrations of 25 to 30 ppm cause severe respiratory tract injury leading to pulmonary edema and pneumonitis. May be fatal in high concentrations.

Ingestion:

Can cause severe abdominal pain, violent vomiting, headache, and diarrhea. Larger does may produce decreased body temperature, pain in the digestive tract, shallow respiration, weak irregular pulse,

unconsciousness and death. Methanol component affects the optic nerve and may cause blindness.

Skin Contact:

Toxic. May cause irritation to skin with redness, pain, and possibly burns. Skin absorption may occur with symptoms paralleling those from ingestion. Formaldehyde is a severe skin irritant and sensitizer. Contact causes white discoloration, smarting, cracking and scaling.

Eye Contact:

Vapors cause irritation to the eyes with redness, pain, and blurred vision. Higher concentrations or splashes may cause irreversible eye damage.

Chronic Exposure:

Frequent or prolonged exposure to formaldehyde may cause hypersensitivity leading to contact dermatitis. Repeated or prolonged skin contact with formaldehyde may cause an allergic reaction in some people. Vision impairment and enlargement of liver may occur from methanol component. Formaldehyde is a suspected carcinogen (positive animal inhalation studies).

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or eye problems, or impaired liver, kidney or respiratory function may be more susceptible to the effects of the substance. Previously exposed persons may have an allergic reaction to future exposures.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:

If swallowed and the victim is conscious, dilute, inactivate, or absorb the ingested formaldehyde by giving milk, activated charcoal, or water. Any organic material will inactivate formaldehyde. Keep affected person warm and at rest. Get medical attention immediately. If vomiting occurs, keep head lower than hips.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:

Monitor arterial blood gases and methanol levels after significant ingestion. Hemodyalysis may be effective in formaldehyde removal. Use formic acid in urine and formaldehyde in blood or expired air as diagnostic tests.

5. Fire Fighting Measures

Fire:

Flash point: 85° C (185°F) cc

Combustible liquid and vapor! Gas vaporizes from solution and is flammable in air.

Explosion:

Above the flash point, explosive vapor-air mixtures may be formed. Containers may explode when involved in a fire.

Fire Extinguishing Media:

Water spray, dry chemical, alcohol foam, or carbon dioxide.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

Water spray may be used to keep fire exposed containers cool. Use water spray to blanket fire, cool fire exposed containers, and to flush non-ignited spills or vapors away from fire.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e.g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Store in a tightly closed container. Protect against physical damage. Outside or detached storage is preferred. Inside storage should be in a standards flammable liquids storage room or cabinet. Separate from oxidizing materials. Storage and use areas should be No Smoking areas. Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Protect from freezing. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

-OSHA Permissible Exposure Limit (PEL):

0.75 ppm (TWA), 2ppm (STEL), 0.5 ppm (TWA) action level for formaldehyde

200 ppm (TWA) for methanol

-ACGIH Threshold Limit Value (TLV):

0.3 ppm Ceiling formaldehyde, A2 Suspected Human Carcinogen

200 ppm (TWA) 250 ppm (STEL) skin for methanol

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work

area. Please refer to the ACGIH document, “Industrial Ventilation, A Manual of Recommended Practices”, most recent edition, for details.

Personal Respirator (NIOSH Approved)

If the exposure limit is exceeded, a full facepiece respirator with a formaldehyde cartridge may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres. Irritation also provides warning. For Methanol: If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

Other Control Measures:

See OSHA Standard for more information on personal protective equipment, engineering and work practice controls, medical surveillance, record keeping, and reporting requirements. (29 CFR 1910.1048)

9. Physical and Chemical Properties

Appearance: Clear, colorless solution. Boiling Point: ~100°C (~212°F)

Odor: Slight pungent odor. Melting Point: ~0°C (~32°F)

Solubility: Soluble in water. Vapor Density (Air=1):

Specific Gravity: ~1.0 Essentially the same as water.

pH: No information found. Vapor Pressure (mm Hg):

% Volatiles by volume @ 21°C (70°F): Essentially the same as water.

100 Evaporation Rate (BuAc=1): Essentially the same as water.

10. Stability and Reactivity

Stability: Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

May form carbon dioxide, carbon monoxide, and formaldehyde when heated to decomposition.

Hazardous Polymerization: Will not occur

Incompatabilities:

Incompatible with oxidizing agents and alkalis. Reacts explosively with nitrogen dioxide at –180° C (356° F). Reacts violently with perchloric acid, perchloric acid-aniline mixtures, and nitromethane. Reaction with hydrochloric acid may form bis-chloromethyl ether, and OSHA regulated carcinogen.

Conditions to Avoid: Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Formaldehyde: Oral rat LD50: 100 mg/kg; skin rabbit LD50: 270 uL/kg, Irritation data: eye, rabbit, 750ug Severe; inhalation rate LC50: 203 mg/$m^{3;}$ investigated as a tumorigen, mutagen, reproductive effector; Cancer Status: an OSHA regulated carcinogen. Methanol: oral rat LD50: 5628 mg/kg; inhalation rat LC50: 64000 ppm/4H; skin rabbit LD50: 15800 mg/kg; investigated as a tumorigen, mutagen, reproductive effector.

-- NTP Carcinogen—

Cancer Lists

Ingredient	Known	Anticipated	IARC Category
Methyl Alcohol (67-56-1)	No	No	None
Formaldehyde (50-00-0)	No	Yes	2A
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:

The following statements refer to the environmental fate of formaldehyde. When released into the soil, this material is expected to leach into groundwater. When released into water, this material is expected to readily biodegrade. When released into water, this material is not expected to evaporate significantly. This material is not expected to significantly bioaccumulate. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to be readily degraded by photolysis. When released into the air, this material is

expected to be readily removed from the atmosphere by dry and wet deposition. When released into the air, this material is expected to have a half-life of less than 1 day. The following statements refer to the environmental fate of methanol. When released into the soil, this material is expected to readily biodegrade. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material is expected to readily biodegrade. When released into the water, this material is expected to have a half-life between 1 and 10 days. When released into the air, this material is expected to exist in the aerosol phase with a short half-life. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition. When released into air, this material is expected to have a half-life between 10 and 30 days.

Environmental Toxicity:

The following toxicity information is for the formaldehyde portion. this material is expected to be slightly toxic to aquatic life. The LC5096-hour values for fish are between 10 and 100 mg/1. The methanol portion is expected to be slightly toxic to aquatic life. The LC50/96-hour values for fish are between 10 and 100 mg/1.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations.

Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

Chemical Inventory Status

					--Canada--			
Ingredient	TSCA	EC	Japan	Australia	Korea	DSL	NDSL	Phil.
Methyl Alcohol (67-56-1)	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Formaldehyde (50-00-0)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes

Federal, State & International Regulations

	--SARA 302--		---------SARA 313-------		-RCRA--TSCA-		
Ingredient	RQ	TPQ	List	Chemical Catg.	CERCLA	261.33	8(d)
Methyl Alcohol (67-56-1)	No	No	Yes	No	5000	U154	No
Formaldehyde (50-00-0)	100	500	Yes	No	100	U122	No
Water (7732-18-5)	No	No	No	No	No	No	No

CHEMICAL WEAPONS CONVENTION: NO .....TSCA 12(B): NO .....CDTA: NO

SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No Reactivity: No (Mixture/Liquid)

Warning:

THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: 2T Australian Poison Schedule: No information found.

WHMIS: This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 3 Flammability: 2 Reactivity: 0

Label Hazard Warnings:

DANGER! MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN, CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT, STRONG SENSITIZER, MAY CAUSE BLINDNESS, COMBUSTIBLE LIQUID AND VAPOR. SUSPECT CANCER HAZARD. CONTAINS FORMALDEHYDE WHICH MAY CAUSE CANCER. Risk of cancer depends upon duration and level of exposure.

Label Precautions: Keep away from heat, sparks and flame. Do not breathe vapor. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Do not get in eyes, on skin, or on clothing. Physical and health hazard information is available from employer and from material safety data sheets.

Label First Aid: In all cases call a physician. If swallowed and the victim is conscious, dilute, inactivate, or absorb the ingested formaldehyde by giving milk, activated charcoal, or water. Any organic material will inactivate formaldehyde. Keep affected person warm and at rest. If vomiting occurs, keep head lower than hips. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes.

Product Use: Laboratory Reagent.

Revision Information: MSDS Section(s) changed since last revision of document include: 3, 4, 16.

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Prepared by: Strategic Services Division
Phone Number (314) 539-1600 (U.S.A.)

Spartan Chemical Company, Inc.
Material Safety Data Sheet

SECTION I: PRODUCT INFORMATION

Product Name or Number (as it appears on label):
SPARQUAT 256
Product Number: 1025

Product Division:
Janitorial

Spartan Chemical Company, Inc.

1110 Spartan Drive
Maumee OH 43537

Product/Technical Information: **1-(800)-537-8990**

Medical Emergency: **1-(888)-314-6171 (24 hours)**

Chemical Leak/Spil Emergency: **CHEMTREC 1-(800) 424-9300 (24 hours)**

Shipping Description:	Disinfectants, liquid, corrosive, n.o.s., 8, UN 1903, II, contains didecyl dimethyl ammonium chloride, n-alkyl dimethyl benzyl ammonium chloride

NFPA Ratings:		**HMIS Ratings:**	
Health:	3 - Serious	**Health:**	3 - Serious
Fire:	0 - Minimal	**Fire:**	0 - Minimal
Reactivity:	0 - Minimal	**Reactivity:**	0 - Minimal
		Pers. Prot. Equip.:	See Section VIII

SECTION II: HAZARDOUS INGREDIENTS

(Listed when present at 1% or greater, carcinogens at 0.1% or greater) All component chemicals are listed or exempted from listing on the "TSCA Inventory" of chemical substances maintained by the U.S. Environmental Protection Agency.

Chemical Name(s)	% W	CAS Registry No.	Table Z- 1 - A			NTP, IARC or OSHA Carcinogen
			TWA mg/m^3	STEL mg/m^3	CELING mg/m^3	
Dialkyl dimethyl ammonium chloride	5-10	68424-95-3	Not Established	Not Established	Not Established	No
Alkyl dimethyl benzyl ammonium chloride	5-10	68424-85-1	Not Established	Not Established	Not Established	No
Nonyl phenol ethoxylate	5-10	9016-45-9	Not Established	Not Established	Not Established	No
Sodium sesquicarbonate	1-5	533-96-0	Not Established	Not Established	Not Established	No
Ethyl alcohol	1-5	64-17-5	1900	Not Established	Not Established	No
Tetrasodium ethylene diaminetetraacetate	1-5	64-02-8	Not Established	Not Established	Not Established	No

SECTION III: PHYSICAL DATA

Boiling Point:	212 °F	Vapor Pressure:	Unknown
Vapor Density (AIR = 1):	Unknown	Solubility in Water:	Complete
pH:	10-10.5	Specific Gravity (H_2O=1):	1.025
Evaporation Rate (but.ace.=1):	<1	Percent Solid by Weight:	25-26
Physical State:	Liquid		

Appearance & Odor:	Aqua colored liquid, slight citrus fragrance

SECTION IV: FIRE & EXPLOSIVE HAZARD DATA

Flash Point:	> 212 °F	Method Used:	ASTM-D56
Flammable Limits:	N/A	Flame Extension:	N/A

Extinguishing Media:	Product does not support combustion. Use extinguishing media appropriate for surrounding fire.
Special Fire Fighting Procedures:	Wear NIOSH approved self-contained breathing apparatus and protective clothing. Cool fire-exposed containers with water spray.
Unusual Fire & Explosive Hazards:	Products of combustion are toxic.

SECTION V: HEALTH HAZARD DATA

Threshold Limit Value:	Not Established	Primary Routes of Entry:	Inhalation, Skin Contact, Eyes & Oral

Effects of Overexposure-Conditions to Avoid:	**CORROSIVE:** **CAUSES IRREVERSIBLE EYE DAMAGE:** Symptoms may include pain, redness, swelling of the conjunctiva and tissue damage. **CAUSES SKIN BURNS:** Symptoms may include pain, redness and tissue destruction. May be fatal if absorbed through the skin. **HARMFUL IF SWALLOWED:** Symptoms may include nausea, vomiting, pain and diarrhea. **INHALATION OF SPRAY MIST MAY BE HARMFUL OR IRRITATING:** Breathing spray mist may cause coughing and difficulty breathing. **Do not get in eyes, on skin or clothing. Do not taste or swallow. Avoid inhalation of spray mist. Wash thoroughly with soap and water after handling.**
Conditions Aggravated by Use:	Use of this product may aggravate preexisting skin; eye and respiratory disorders including asthma and dermatitis.

Emergency & First Aid Procedures:

Eyes:	Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses after the first 5 minutes then continue rinsing eye. Get immediate medical attention.
Skin:	Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Get medical attention. Wash contaminated clothing before reuse.
Ingestion:	Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Do not give anything by mouth to an unconscious person.
Inhalation:	In case of respiratory irritation; move person to fresh air. Get medical attention if irritation persists.

SECTION VI: REACTIVITY DATA

Stability:	Stable	Incompatible Materials:	Strong oxidizers
Hazardous Decomposition Products:	CO, CO_2	Hazardous Polymerization:	Will Not Occur

SECTION VII: SPILL OR LEAK PROCEDURES

Steps to be Taken in Case Material is Released or Spilled:	Dike and contain spill with inert material (sand, earth, commercial absorbent, etc.) and transfer to containers for disposal. Rinse area with water and flush to sanitary sewer. Keep spill out of storm sewers and waterways.
Waste Disposal Method:	Dispose of in compliance with all federal, state and local laws and regulations.

SECTION VIII: SPECIAL PROTECTION INFORMATION

Respiratory Protection:	Not normally required when good general ventilation is provided. However, if exposure limits (see Section II) are exceeded or if respiratory irritation occurs, use of a NIOSH approved respirator suitable for the use-conditions and chemicals in Section II should be considered.
Ventilation:	Provide good general ventilation. Local exhaust ventilation may be necessary for some operations.
Protective Gloves(Specify Type):	Rubber or other water-proof gloves are recommended.
Eye Protection(Specify Type):	Splash goggles and/or face shield
Other Protective Equipment:	Eye wash stations and washing facilities should be readily accessible in areas where undiluted product is handled.. See 29 CFR 1910.132-138 for further guidance.

SECTION IX: SPECIAL PRECAUTIONS

Precautions; Handling & Storing:	Keep from freezing. Store at temperatures below 140 F. Keep containers closed until used. Do not contaminate drinking water; food or feed by storage or disposal.
Other Precautions:	Keep out of reach of children.

SPARQUAT 256

Name: Ronald T. Cook Title: Manager, Regulatory Affairs
Effective Date: 07/29/2005 Supercedes: 06/30/2005
Ref: 29 CFR 1910.1200 (OSHA) Changes: Update shipping description

Appendix E

Formalin Health and Safety

FORMALIN HEALTH AND SAFETY

All field and laboratory activities will be performed in accordance with the Occupational Safety and Health Administrations' requirements for a safe work place. It is the responsibility of the participants to establish and implement the appropriate health and safety procedures for the work being performed. All field staff are expected to review and understand the Material Safety Data Sheet and the Chemical Fact Sheet for chemicals of concern provided by field staff supervisors. Field staff are instructed to immediately report to their supervisor the development of any adverse signs or symptoms that they suspect are attributable to chemical exposure.

The environmental samples scheduled to be collected during this Program will be obtained from surface water bodies located in natural settings. Samples to be collected include fish specimens and aquatic macroinvertebrates. The sample stations and samples to be collected are not considered to be hazardous; however, sample preservation materials include formalin (formaldehyde), which requires prudent safety precautions by those collecting samples and those coming into contact with or disposing of samples collected during this Program.

Hazardous Materials (Formaldehyde)

Commercial grade formalin contains 37 to 55 percent formaldehyde. The use of formaldehyde and its derivatives are regulated under 29 CFR 1910.1048. Formaldehyde is a suspected human carcinogen. Formaldehyde is highly flammable, and is incompatible with strong oxidizers, strong alkalies, acids, phenols, and urea.

Formaldehyde Exposure Limits

There may be no safe level of exposure to a carcinogen, so all contact with formalin should be reduced to the lowest possible level. The odor threshold of 0.83 parts per million (ppm) for formaldehyde serves only as a warning of exposure. The permissible exposure limit (PEL) for formaldehyde is 0.75 ppm averaged over an eight-hour work shift. The time-weighted average (TWA) for airborne concentrations of formaldehyde (STEL) is 2 ppm. The American Conference of Governmental Industrial Hygienist recommend airborne exposure limit to formaldehyde is not to exceed 0.3 ppm averaged over an eight-hour work period.

Respirators shall be used when 1) installing feasible engineering and work practice controls, 2) engineering and work practice controls are not feasible, and 3) engineering and work practice controls are not sufficient to reduce exposure to or below the Permissible Exposure Limit. Respirator use should be limited to an MSHA/NIOSH approved supplied air respirator with a full face piece operated in the positive mode or with a full face piece, hood, or helmet operated in the continuous flow mode. A MSHA/NIOSH approved self-contained breathing apparatus with a full-face piece operated in pressure demand or other positive mode is also recommended.

Formaldehyde exposure occurs through inhalation and absorption. Exposure irritates the eyes, nose, and throat, and can cause skin and lung allergies. Higher levels can cause throat spasms and a build-up of fluid in the lungs, cause for a medical emergency. Contact can cause severe eye and skin burns, leading to permanent damage. These may appear hours after exposure, even if no pain is felt.

Formaldehyde First Aid

If formaldehyde gets into the eyes, remove any contact lenses at once and irrigate immediately with deionized water, distilled water or saline solution. If formaldehyde contacts exposed skin, flush with water promptly. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration, if needed. When formaldehyde has been swallowed, get medical attention. Give large quantities of water and induce vomiting. Do not make an unconscious person vomit.

Formaldehyde Fire and Explosion Hazard

Mixtures of air and free formaldehyde gas are highly flammable. Formalin is a combustible liquid, and presents a moderate fire and explosion hazard. Use a dry chemical, carbon dioxide, water spray, or "alcohol" form to extinguish formalin fires. Store formalin solutions in insulated, closed containers in a cool, dry, well-ventilated area separate from oxidizing agents and alkaline materials. Protect formalin containers from physical damage.

Formalin Spill Procedures

In case of a spill or leak, eliminate all sources of ignition, provide adequate ventilation, notify supervisor, and evacuate all nonessential personnel. Neutralize spilled formalin with aqueous ammonia or mix with sodium sulfite. Wash residues with diluted ammonia to eliminate vapor. Prevent runoff from entering streams, surface waters, waterways, watersheds, and sewers.

Formalin Work Area Controls

Work area locations at stream sampling stations will be selected to ensure adequate ventilation when sample container lids are removed. Work area locations will be located downwind from field crew activities, and will be isolated from field crew traffic. A single field crew member will be designated and authorized to secure the formaldehyde work area at sampling stations. This crew member will ensure proper handling of sample containers and fish specimens, and will be responsible for establishing proper precautions for minimizing field crew exposure to formaldehyde at sampling stations.

Formalin Work Area Practices

Formalin (formaldehyde) is being used in this protocol for the purpose of asphyxiation and preservation of fish specimens. Pre-labeled and pre-preserved plastic sample containers will be delivered to the field crew secured in large ice chests. Field crews will transport the containers in the coolers to the field sample stations. Fish specimens will be collected by hand and placed into the sample containers. Container lids will be removed immediately prior to, and closed immediately after fish specimens and specimen labels are placed into the sample container. Specimens will be placed into the sample container and minimize the amount of time the sample preservative is not contained. The sample container will be placed into a large plastic bag and secured in an ice cooler until delivered to the laboratory for analysis.

Formalin Personal Protection

Field crew members within the designated formalin work area at sample stations will wear a full face shield, impervious nitrile, butyl rubber, or viton gloves, boots and aprons, etc. to prevent excessive or prolonged skin contact. Contact lenses will not be worn within the designated formalin work area. No eating, drinking, or smoking will be allowed in the designated formalin work area.

Wash thoroughly after using formalin. Avoid transferring formalin from hands to mouth while eating, drinking, or smoking. Avoid direct contact with formalin. Remove contaminated clothing and launder before wearing. Contaminated work clothing should not be taken home. Contaminated work clothing should be laundered by individuals who have been informed of the hazards of exposure to formalin.

Appendix F

Habitat Assessment Charts

Habitat Assessment Data Sheet

Longitudinal Habitat Distribution

Riffle & Run Habitats: areas of the stream with faster current and shallower depth; typically much of the water surface is visibly broken. Look for in Rosgen A-type channels, and streams with coarser substrate. Can have numerous pools.

Glide & Pool Habitats: usually few riffles and slower water column velocity. Generally, but not always, deeper than riffle/run habitats. Look for in lower gradient stream segments; often seen in wide, flat valleys. Usually depositional in character. Number of pools can vary.

Habitat Assessment

1. *Instream Cover (for fish):*

Greater than 50% mix of cobble, gravel, woody debris, undercut banks, or other stable fish cover.	30-50% mix of cobble, gravel, or other stable fish cover. Adequate cover.	10-30% mix of cobble, gravel, or other stable fish cover. Cover availability is less than desirable.	Less than 10% cobble, gravel or other stable fish cover. Lack of cover is obvious.
16 – 20	11 – 15	6 – 10	0 – 5

2. *Embeddedness (in riffles):*

Gravel, cobble and boulder particles are 0-25% surrounded by fine sediment (particles less than 6.35mm).	Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble and boulder particles are >75% surrounded by fine sediment, or bottom is sand, clay or bedrock.
16 – 20	11 – 15	6 – 10	0 – 5

3. *Channel Shape (see opposite for further guidance):*

Trapezoidal	Rectangular	Inverse Trapezoidal
		
11 – 15	6 – 10	0 – 5

4. *Disruptive Pressures (on streambank, immediately adjacent to stream):*

Vegetative disruption minimal or not evident. Almost all potential plant biomass at present stage of development remains.	Disruption evident but not affecting community vigor. Vegetative use is moderate, 60-90% of the potential plant biomass remains.	Disruption obvious; some patches of bare soil or closely cropped vegetation present. 30-60% of potential plant biomass remains.	Disruption of streambank vegetation is very high. Vegetation has been removed to less than 30% of the potential plant biomass.
9 – 10	6 – 8	3 – 5	0 – 2

5. *Zone of Influence (width of riparian vegetative zone, least buffered side):*

Width of riparian vegetative zone (on each side) is at least 4 times the width of the stream. Human activities have caused no impact at all.	Width of riparian vegetative zone (on each side) is at least twice the width of the stream. Human activities have caused minimal impact.	Width of riparian vegetative zone (each side) is at least as wide as the stream. Human activities have caused a great deal of impact.	Little or no riparian vegetation due to man induced activities (parking lots, clearcuts, lawns or crops planted to the edge of the stream).
9 – 10	6 – 8	3 – 5	0 – 2

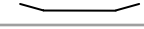
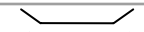
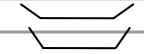
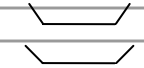
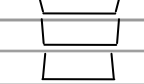
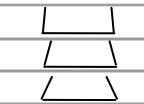
6. *Pool Substrate Characteristics:*

Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; few or no root mats; no submerged vegetation.	Hard-pan clay or bedrock; no root mats or submerged vegetation.
16 – 20	11 – 15	6 – 10	0 – 5

7. *Pool Variability:*

Even mix of deep, shallow, large and small pools.	Majority of pools large and deep. Very few shallow pools.	Shallow pools much more prevalent than deep pools.	Majority of pools small and shallow, or pools absent.
16 – 20	11 – 15	6 – 10	0 – 5

Channel Shape Guidance
(crew to make final determination, based on field observations)

Mean Bank Angle	Predominant Channel Shape		Score
0-10	Inverse Trapezoidal		1
11-20	Inverse Trapezoidal		2
21-30	Inverse Trapezoidal		3
31-40	Inverse Trapezoidal		4
41-50	Inverse Trapezoidal		5
51-60	Rectangular		6
61-70	Rectangular		7
71-80	Rectangular		8
81-90	Rectangular		9
91-100	Rectangular		10
101-110	Trapezoidal		11
111-120	Trapezoidal		12
121-130	Trapezoidal		13
131-140	Trapezoidal		14
> 140	Trapezoidal		15

Habitat Assessment Data Sheet
ROSGEN STREAM TYPE

Determining Stream Type

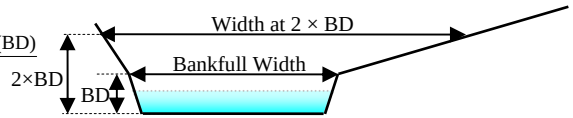
Entrenchment Ratio	Gradient	Further Attributes
< 1.4 (entrenched)	**> 4%**	**A**
	2% – 4%	Low bankfull width/depth ratio (<12): **G** High bankfull width/depth ratio (>12): **F**
2.2 - 1.4 (slightly entrenched)	**2% – 4%**	Riffle-dominated, moderate sinuosity: **B**
> 2.2 (not entrenched)	**< 2%**	Very low bankfull width/depth ratio (<6) and high sinuosity: **E** High bankfull width/depth ratio (>12) and moderate-high sinuosity:**C**
N/A	**< 4%**	Multiple channels (three or more braids): **D**

Calculating Entrenchment Ratio

Entrenchment ratio is a measure of how easily the stream can access its floodplain during flood stage, defined as twice bankfull depth. Bankfull depth is the *depth* that water would be at its bankfull stage, measured in the thalweg. Note that this is different from bankfull *height*, the measure used in BURP.

To calculate entrenchment ratio, measure or estimate the channel width at bankfull and twice bankfull depths. It would be helpful to take this measurement at one of the width/depth transects because the bankfull width has already been measured.

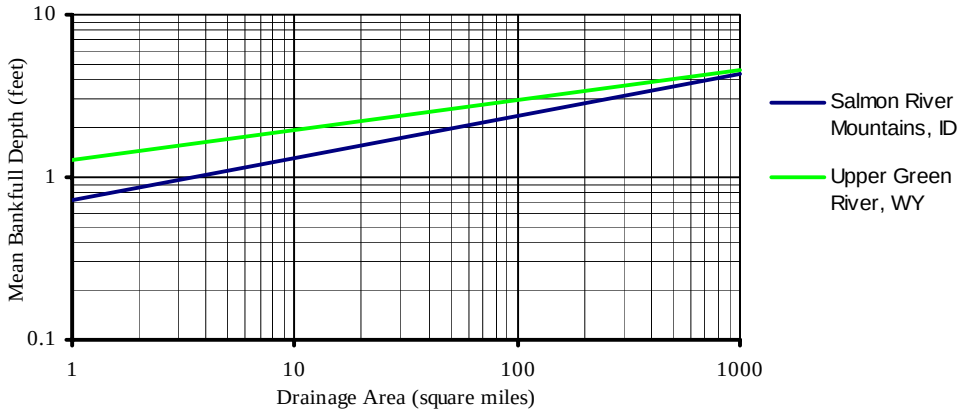
$$\text{Entrenchment Ratio} = \frac{\text{Width at } 2 \times \text{Bankfull Depth (BD)}}{\text{Bankfull Width}}$$

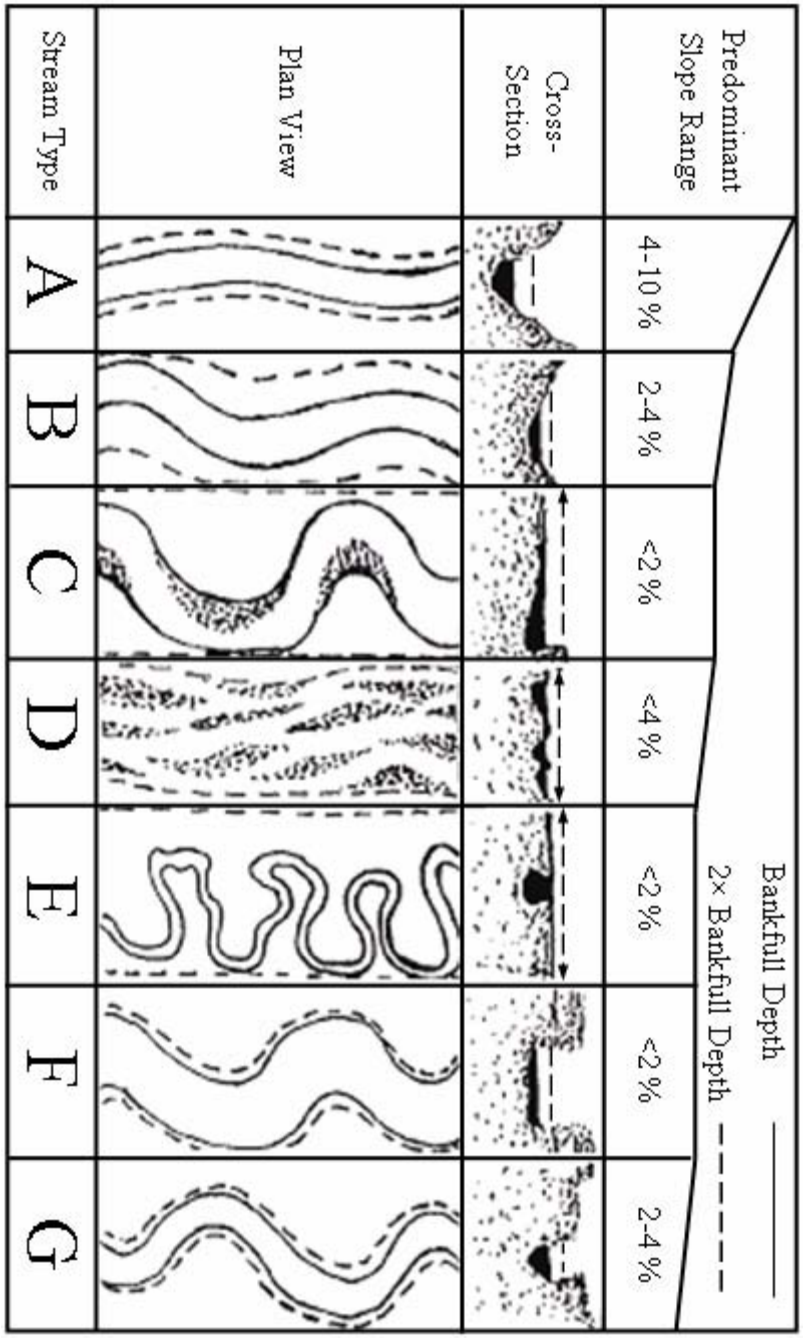


Further Information

Type	General Description
A	Steep, cascading, laterally contained step/pool streams, typically of low stream order.
B	Moderately steep, riffle-dominated channel, with infrequently spaced pools and stable banks.
C	Meandering, riffle/pool channel with broad, well-defined floodplains and point bars
D	Braided channel with very high bankfull width/depth ratio (>40). Bars and eroding banks.
E	Tortuously meandering, with little deposition. Often found in flat-bottomed valleys and meadows.
F	Deeply entrenched, wide and shallow bankfull channel. Little or no visible flood plain.
G	Narrow, deep bankfull channel (a gully). Gradient may be <2% in downcut meadow sections.

Estimating Bankfull *(after Emmett 1975)*





Appendix G

Electrofishing Safety Orientation and Acknowledgement

Electrofishing Safety Policy and Plan

1. **Purpose**
   The purpose is to ensure human safety during electrofishing operations by establishing Department of Environmental Quality competency requirements for electrofishing operations. This plan also provides guidelines for a standard operating procedure and the safe operation of electrofishing equipment.

2. **Scope**
   The provisions of this plan apply to all IDEQ activities using electricity (produced by gasoline powered generator/alternators or batteries) to sample animals in aquatic habitats.

3. **Policy**
   IDEQ recognizes the electrofishing operation as a hazardous activity for which skills and training is required. It is, therefore, IDEQ policy that all personnel serving as BURP (Beneficial Use Reconnaissance Program) coordinators demonstrate knowledge of the principles and techniques of electrofishing. BURP coordinators will be considered knowledgeable of the principles and techniques of electrofishing upon satisfactory completion of the Principles and Techniques of Electrofishing course or equivalent training.

4. **Responsibilities**
   A. The IDEQ Health and Safety Coordinator is responsible for maintaining a current listing of all IDEQ personnel who have attended electrofishing training.

   B. The IDEQ Regional Administrators are responsible for ensuring compliance with the provisions of this plan.

   C. BURP Coordinators are responsible for:
      1) Providing electrofishing crews with the proper equipment, and ensuring that such equipment is fully functional at the beginning of the field season.
      2) Ensuring that the electrofishing crews have and utilize the proper safety equipment.
      3) Ensuring that all crew members are first aid and CPR certified.
      4) Ensuring the availability of a well-equipped, water-tight first aid kit.
      5) Discussing potential hazardous conditions encountered during electrofishing operations with crew members
      6) Ensuring that all crew members are trained in proper electrofishing techniques.
      7) Designating an electrofishing team leader.

   D. Electrofishing Team Leader. Only individuals demonstrating knowledge of electrofishing techniques can serve as electrofishing team leaders. As the individuals in charge of electrofishing operations, the team leaders are responsible for the following:
      1) Identifying hazardous field conditions associated with proposed electrofishing operations, determining measures to protect electrofishing team members, and appropriately briefing team members.
      2) Ensuring precautions are taken in the field to avoid harm to the public, domestic animals, or wildlife

3) Ensuring that all electrofishing operations cease, and all crew members go ashore in the event of inclement weather.
4) Ensuring that electrofishing operations include only those persons necessary to conduct a safe and efficient operation and those members being trained.
5) Reviewing the electrofishing considerations checklist and ensuring the addition of specialized items to the checklist that pertain to their Regions or operation.
6) Inspecting electrofishing equipment during the field season to assure that it is properly functioning. If repairs are needed, this must be brought to the attention of the Regional BURP coordinator.

E. All crew members must know who their leader is and recognize his/her authority as final in operational decisions. Every crew member has the right to ask questions about any aspect of an electrofishing operation. A crew member has the right to decline participation in the operation if he/she feels unsafe working in the field conditions present. Crew members are responsible for reporting all potential work hazards, accidents, incidents, and job-related illnesses/injuries to their regional BURP coordinator.

5. Training and Education
   A. It is recommended that BURP Coordinators attend the Principles and Techniques of Electrofishing course so that they have knowledge of the following:

      1) The basic principles of electricity and transmission of current in water.
      2) The basic concept and design guidelines for electrofishing equipment.
      3) Electrofishing equipment, the equipment's capabilities, limitations, and safety features.
      4) The safety precautions to employ, while using electrofishing equipment.

   B. All members of the electrofishing crew must have a current certification in cardiopulmonary resuscitation (CPR) and first aid. All crew members will be briefed in the following areas:

      1) Hazards involved in electrofishing.
      2) Safe operation of electrofishing equipment.
      3) Basic emergency procedures for drowning, unconsciousness, and electrical shock.
      4) Communication between electrofishing crew members while operating equipment.
6. Standard Safety Equipment
   A. All persons using portable electrofishers will wear protective gear which will insulate the wearer from electrical shock, preferably chest waders, but rubber hip boots would suffice. All footwear will be equipped with non-slip soles.

   B. Appropriate gloves will be worn and will be inspected for punctures before each use. They will be replaced if damaged.

   C. Polarized sunglasses will be worn when there is glare on the water.

7. Standard Operating Procedure

All persons must be aware of the hazards involved in using portable electrofishers in running waters, such as slippery surfaces, swift water currents, deep areas; and obstacles, such as logs or similar objects.

A. A minimum of three people should be present to conduct electrofishing operations.

B. At all times during the electrofishing operation, the crew must communicate as to whether or not the unit is putting power into the water. If a crew member must reach into the water with their hands, it is their responsibility to inform the person operating the equipment, so they can stop the operation. Communication between crew members is essential to a safe operation.

C. Netters will work beside or behind the individual with the electrofishing equipment to ensure the electrical field is well in front of both workers.

D. Crew members should only perform one job at a time. A person should not be carrying the bucket of fish and netting at the same time.

E. While walking in the stream, make sure that one foot is securely planted before stepping with the other foot. Do not cross one leg over the other, especially while walking in swift water.

F. The individual operating the electrofishing unit should not turn the power on until all crew members are in position and have stable footing.

G. Crew members will cease electrofishing operations during inclement weather; use discretion during rain.

H. All safety equipment will be utilized.

I. All operating manuals for electrofishing equipment must be available to the crew while in the field.

8. Portable Electrofisher Equipment Specifications and Operation
Only professionally-produced electrofishing equipment should be used, and the equipment should not be altered in any way.

A. Electrodes

1) Electrode handles will be constructed of a nonconductive material, and be long enough to avoid hand contact with the water.

2) The positive electrode (anode) used with portable electrofishers will be equipped with a magnetic switch that interrupts the electric current upon release.

B. Portable Electrical Power Source

1) Batteries used as an electrical power source for backpack shockers will be of the gel type that will not leak when tipped or overturned.

2) Backpacks will be equipped with a quick-release belt (hip) and shoulder straps.

C. Power Control

1) The operator will have a switch to the pulsator or power control unit in order for the electricity to be turned off quickly in an emergency.

2) All equipment purchased after October 1, 1985 must be equipped with a tilt switch that breaks the circuit if the operator falls.

Idaho Beneficial Use Reconnaissance Program

Acknowledgement of Electrofishing Training

I have received instruction and orientation about electrofishing from the Idaho Department of Environmental Quality. As a result, I understand and accept the following principles:

1. Electrofishing (EF) is an inherently hazardous activity in which safety is the primary concern. The electrical energy used in EF is sufficient to cause electrocution. During operations, it is critical to avoid contact with the electrodes and surrounding water. The EF field is most intense near the electrodes, but can extend outward 10-20 feet.
2. A communication system must be known by all members of an EF crew. A minimum of three people are recommended for all EF operations. Crew members should only perform one job at a time (e.g. a person should not be carrying the bucket of fish and netting at the same time).
3. The individual operating the electrofishing unit should not turn the power on until all crew members are in position, have stable footing, and all members agree to begin.
4. An EF operation should proceed slowly and carefully; avoid fish-chasing and other sudden maneuvers. Operations should cease during inclement weather; use discretion during rain.
5. The main power switch must be turned off immediately, if an emergency occurs.
6. Rubber knee boots are minimal foot protection, as are rubber gloves for the hands. Chest-waders with felt soles are recommended. Ear protection is recommended for those working near the generator. Crews will be provided with the necessary safety equipment that is in proper working condition.
7. All members of the EF crew must be certified for CPR and first aid. A first aid kit must be accessible during an EF operation.
8. Stunned fish should be removed from the EF field as soon as possible, and not subjected to continuous power by being held in the field. Using the anode as a dip net should be avoided; it is a poor electrofishing technique, and potentially injurious to fish.
9. Measures should be taken to avoid harm to the public, domestic animals, and wildlife. The public cannot participate in electrofishing operations.
10. All EF crew members must know who their leader is and recognize his/her authority as final in operational decisions. However, every crew member has the right to ask questions about any aspect of an EF operation. A crew member has the right to decline participation in an EF operation, without fear of employer recrimination, if he/she feels unsafe in doing such work.

_____ / _____ .

Signature of Employee Date

Appendix H

DEQ Fish Taxon Codes

FTAXACODE	AFSCNAME	AFSSNAME
1	Pacific lamprey	*Lampetra tridentata*
2	white sturgeon	*Acipenser transmontanus*
3	American shad	*Alosa sapidissima*
4	lake whitefish	*Coregonus clupeaformis*
5	chum salmon	*Oncorhynchus keta*
6	coho salmon	*Oncorhynchus kisutch*
7	sockeye salmon	*Oncorhynchus nerka*
8	kokanee	*Oncorhynchus nerka*
9	chinook salmon	*Oncorhynchus tshawytscha*
10	rainbow trout	*Oncorhynchus mykiss*
11	cutthroat trout	*Oncorhynchus clarki*
12	Bear Lake whitefish	*Prosopium abyssicola*
13	pygmy whitefish	*Prosopium coulteri*
14	Bonneville cisco	*Prosopium gemmiferum*
15	Bonneville whitefish	*Prosopium spilonotus*
16	mountain whitefish	*Prosopium williamsoni*
17	golden trout	*Oncorhynchus aguabonita*
18	Atlantic salmon	*Salmo salar*
19	brown trout	*Salmo trutta*
20	Arctic char	*Salvelinus alpinus*
21	brook trout	*Salvelinus fontinalis*
22	bull trout	*Salvelinus confluentus*
23	lake trout	*Salvelinus namaycush*
24	Arctic grayling	*Thymallus arcticus*
25	rainbow smelt	*Osmerus mordax*
26	northern pike	*Esox lucius*
27	chiselmouth	*Acrocheilus alutaceus*
28	goldfish	*Carassius auratus*
29	lake chub	*Couesius plumbeus*
30	common carp	*Cyprinus carpio*

FTAXACODE	AFSCNAME	AFSSNAME
31	Utah chub	*Gila atraria*
32	tui chub	*Gila bicolor*
33	leatherside chub	*Gila copei*
34	peamouth	*Mylocheilus caurinus*
35	fathead minnow	*Pimephales promelas*
36	northern pikeminnow	*Ptychocheilus oregonensis*
37	longnose dace	*Rhinichthys cataractae*
38	leopard dace	*Rhinichthys falcatus*
39	speckled dace	*Rhinichthys osculus*
40	redside shiner	*Richardsonius balteatus*
41	tench	*Tinca tinca*
42	Utah sucker	*Catostomus ardens*
43	longnose sucker	*Catostomus catostomus*
44	bridgelip sucker	*Catostomus columbianus*
45	bluehead sucker	*Catostomus discobolus*
46	largescale sucker	*Catostomus macrocheilus*
47	mountain sucker	*Catostomus platyrhychus*
48	black bullhead	*Ameiurus melas*
49	brown bullhead	*Ameiurus nebulosus*
50	channel catfish	*Ictalurus punctatus*
51	tadpole madtom	*Noturus gyrinus*
52	flathead catfish	*Pylodictis olivaris*
53	sand roller	*Percopsis transmontana*
54	burbot	*Lota lota*
55	western mosquitofish	*Gambusia affinis*
56	guppy	*Poecilia reticulata*
57	green sunfish	*Lepomis cyanellus*
58	pumpkinseed	*Lepomis gibbosus*
59	warmouth	*Lepomis gulosus*
60	bluegill	*Lepomis macrochirus*

FTAXACODE	AFSCNAME	AFSSNAME
61	smallmouth bass	*Micropterus dolomieu*
62	largemouth bass	*Micropterus salmoides*
63	white crappie	*Pomoxis annularis*
64	black crappie	*Pomoxis nigromaculatus*
65	yellow perch	*Perca flavescens*
66	walleye	*Stizostedion vitreum*
67	mottled sculpin	*Cottus bairdi*
68	Paiute sculpin	*Cottus beldingi*
69	slimy sculpin	*Cottus cognatus*
70	shorthead sculpin	*Cottus confusus*
71	Bear lake sculpin	*Cottus extensus*
72	Shoshone sculpin	*Cottus greenei*
73	Wood river sculpin	*Cottus leiopomus*
74	torrent sculpin	*Cottus rhotheus*
75	lamprey	*Lampetra sp.*
76	sturgeon	*Acipenseridae sp.*
77	whitefish	*Coregonus sp.*
78	Pacific salmon/trout	*Oncorhynchus sp.*
79	whitefish	*Prosopium sp.*
80	Atlantic salmon/trout	*Salmo sp.*
81	char	*Salvelinus sp.*
82	grayling	*Thymallus sp.*
83	pike	*Esox sp.*
84	chub (Couesius sp.)	*Couesius sp.*
85	chub (Gila sp.)	*Gila sp.*
86	pikeminnow	*Ptychocheilus sp.*
87	dace	*Rhinichthys sp.*
88	shiner	*Richardsonius sp.*
89	sucker	*Catostomus sp.*
90	catfish	*Ictalurus sp.*

FTAXACODE	AFSCNAME	AFSSNAME
91	trout-perch	*Percopsis sp.*
92	sunfish	*Lepomis sp.*
93	bass	*Micropterus sp.*
94	crappie	*Pomoxis sp.*
95	perch	*Perca sp.*
96	sculpin	*Cottus sp.*
97	herring	*Clupeidae*
98	trout	*Salmonidae*
99	minnow	*Cyprinidae*
100	catfish	*Ictaluridae*
101	guppy	*Poeciliidae*
102	sunfish	*Centrarchidae*
103	perch	*Percidae*
104	bullhead	*Ameiurus sp.*
105	cod	*Lota sp.*
106	smelt	*Osmerus sp.*
107	oriental weatherfish	*Misgurnus anguillicaudatus*
108	weatherfish	*Misgurnus sp.*
109	loach (cobitidae)	*Cobitidae*
110	convict cichlid	*Cichlasoma nigrofasciatum*
111	blue tilapia	*Tilapia aurea*
112	Mozambique tilapia	*Tilapia mossambica*
113	redbelly tilapia	*Tilapia zillia*
114	shortfin molly	*Poecilia mexicana*
115	green swordtail	*Xiphophorus helleri*
116	yellow bullhead	*Ameiurus natalis*
117	steelhead	*Oncorhynchus mykiss*
118	grass carp	*Ctenopharyngodon idella*
119	spottail shiner	*Notropis hudsonius*
120	blue catfish	*Ictalurus furcatus*

FTAXACODE	AFSCNAME	AFSSNAME
121	platy	*Xiphophorus sp.*
122	sauger	*Stizostedion canadense*
123	Umpqua dace	*Rhinichthys evermanni*
124	umatilla dace	*Rhinichthys umatilla*
125	tilapia	*cichlidae*
156	killifish	*Cyprinodontidae*
157	banded killifish	*Fundulus diaphanus*
501	cutthroat trout (all stocks) x rainbow trout	*Oncorhynchus clarki X O. mykiss*
502	brook trout x bull trout	*Salvelinus fontinalis X S. confluentus*
503	brook trout x lake trout (splake)	*Salvelinus fontinalis X S. namaycush*
504	brook trout x brown trout (tiger trout)	*Salvelinus fontinalis X Salmo trutta*
505	tiger muskellunge	*Esox lucius E. masquinongy*
999	fish	*Unidentified*

Appendix I

Electrofishing Checklist

Electrofishing Checklist

Backpack Electrofisher Safety Inspection

Date:_____ Stream: _____

Electrofishing Leader:_____

Crew Members:_____

Manual present? Yes _____ No _____

ELECTROFISHER

_____ 1. Controls and gauges operational

_____ 2. Adequate protection of wiring

_____ 3. Adequate connectors and interlocking

_____ 4. Audible tone generator working

_____ 5. "Kill switch" working

_____ 6. Mercury tilt switch working

_____ 7. Anode switch working

_____ 8. Wiring to anode in good condition

_____ 9. Anode in good condition, fastened securely

_____ 10. No screens or nets attached to anode

_____ 11. Cathode in good condition

_____ 12. Cathode clean, fastened securely

_____ 13. Backpack frame in good condition

_____ 14. Quick release buckle of backpack working

PERSONNEL/CREW MEMBERS

_____ 1. Each crew member briefed on unit operation

_____ 2. It is recommended three or more crew members be present, all CPR certified

_____ 3. Each crew member wearing rubber gloves

_____ 4. Each crew member wearing waders or rubber boots

_____ 5. Safety precautions covered

_____ 6. Local arrangements covered (landowner, Fish & Game)

BATTERY (if applicable)

_____ 1. Fully charged, gel type cell

_____ 2. Terminals clean and tight

ANCILLARY EQUIPMENT

_____ 1. Non-conductive dip net handle

_____ 2. First aid kit present

_____ 3. Fish holding containers

_____ 4. Fish measuring board

_____ 5. Jars with formalin

_____ 6. Fish labels

_____ 7. Fish field forms

_____ 8. Formalin safety equipment